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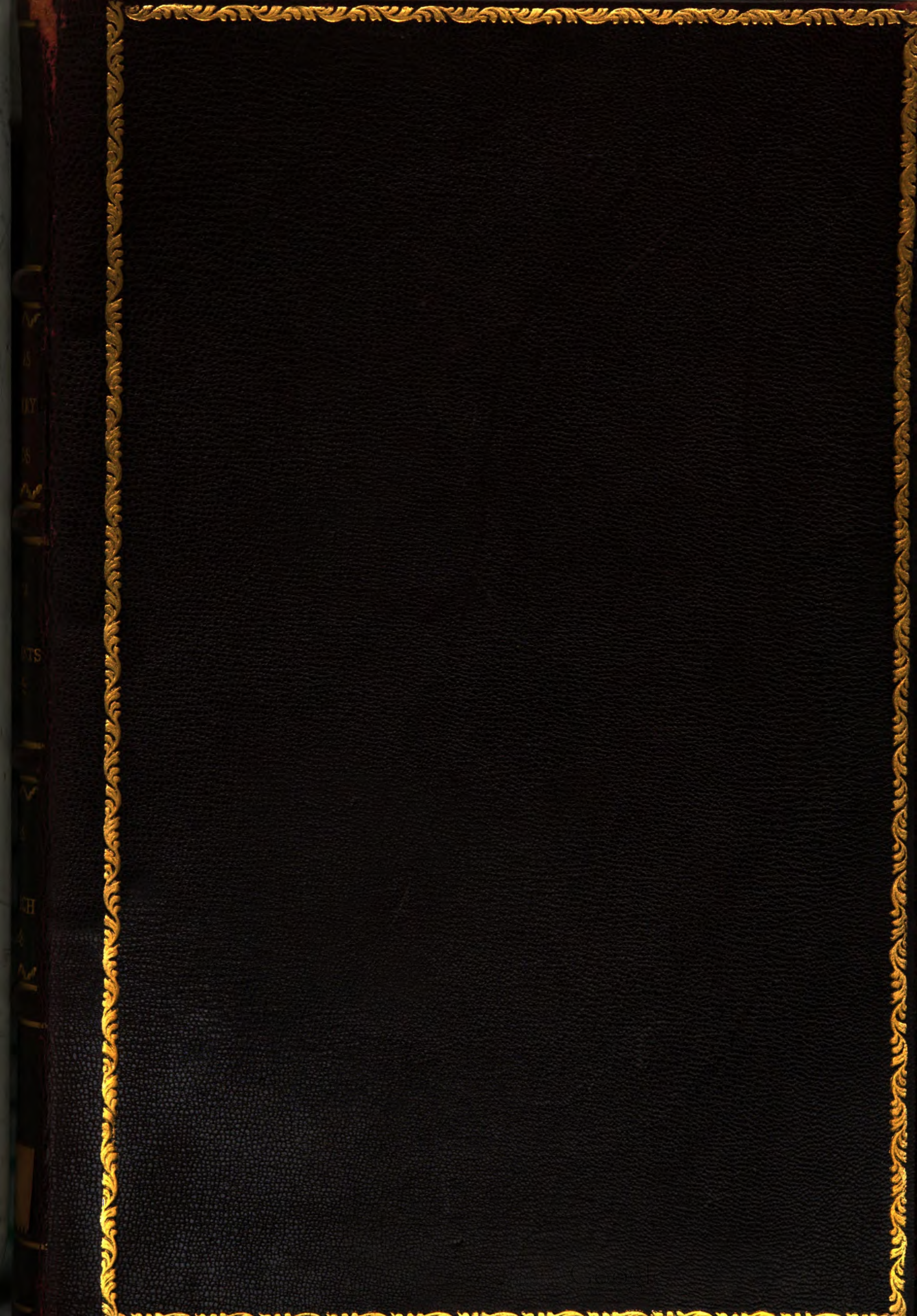

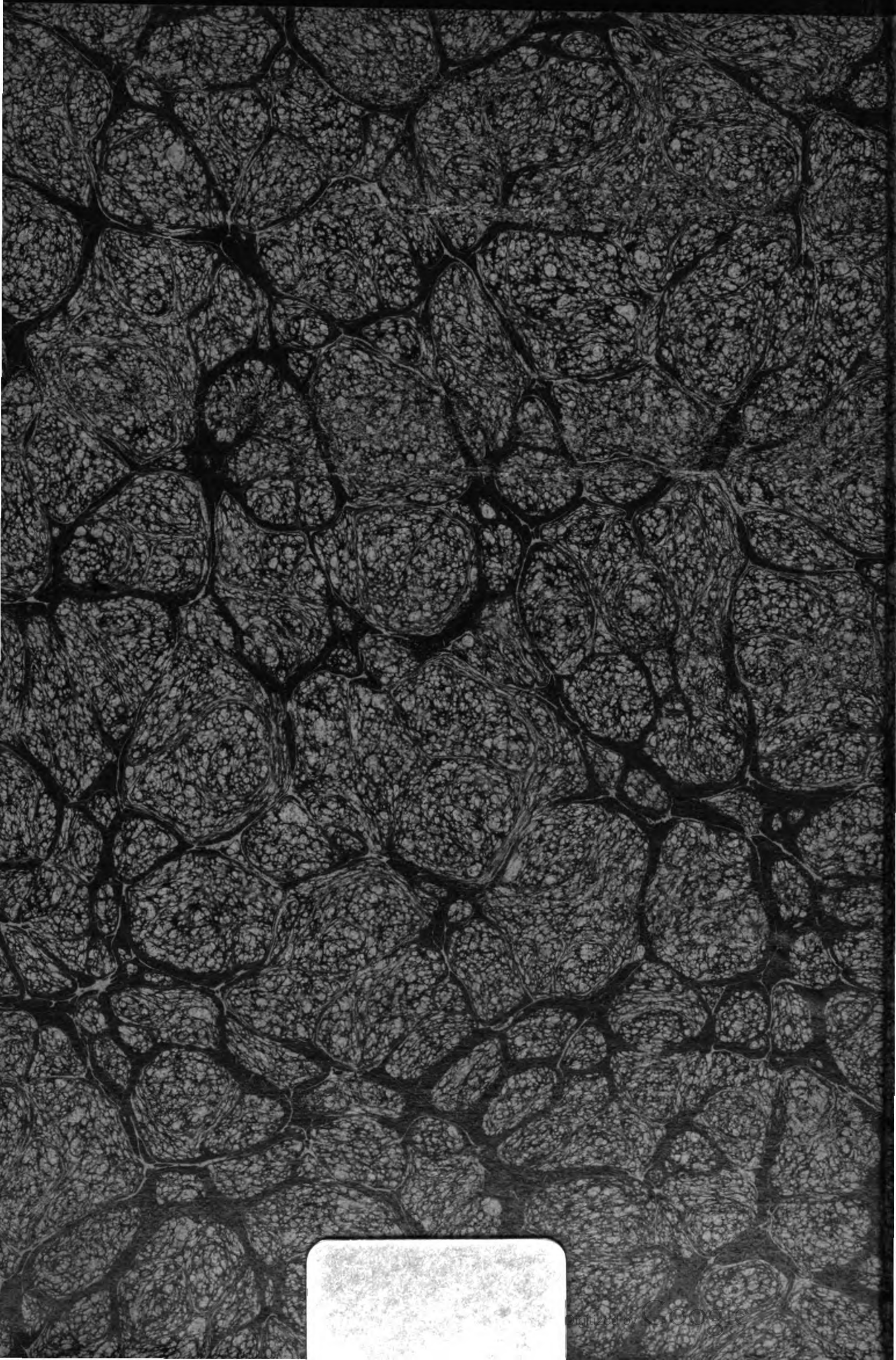

23174 e. 51

PRACTICE AND EXPERIMENTS.

1855.

Table of Ranges with the undermentioned brass 5½ inch Mortars, carried on at Artillery Head Quarters, under instructions from the Military Board in letter No. 7148, dated 12th February 1855, *with 6 charges varying from 2½ to* 10 *oz. and at elevations with each charge of 15°, 30°, 45°, and 60°.*

Charge.	15° Elevation.									30° Elevation.									45° Elevation.									60° Elevation.								
	Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.		
	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.
Ozs.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.
2½	2	20	173	2	..	97	1	45	75	5	50	328	3	55	185	3	10	129	8	35	394	6	20	193	4	35	139	10	30	345	7	5	164	5	20	114
4	4	30	431	3	..	173	2	40	143	8	35	700	5	5	249	4	25	202	11	40	737	7	50	297	6	45	235	15	15	675	9	30	270	8	5	212
5½	5	20	584	3	30	280	3	..	226	10	30	891	6	45	440	6	15	372	13	45	1091	10	20	531	8	55	414	18	40	957	12	30	457	10	40	375
7	6	40	835	4	50	442	4	10	337	13	..	1259	8	35	654	8	..	555	17	45	1365	12	30	760	11	15	627	21	15	1182	15	20	685	12	45	533
8½	7	50	986	5	5	539	4	50	465	14	..	1300	10	15	881	9	15	743	20	15	1709	15	5	972	13	20	874	25	25	1401	18	5	912	15	30	710
10	8	30	1048	7	15	702	5	45	581	17	40	1573	12	..	1004	10	20	920	23	..	1998	16	25	1280	15	30	1052	26	45	1527	20	10	1115	18	55	1001

ARTILLERY DEPOT,
ST. THOMAS' MOUNT,
March 1855.

Note.—1 Madras pattern conical chambered Mortar—Weight Cwt. 1-2-25.
2 Experimental Bengal pattern gomer chambered Mortar, 2 inches longer than the Madras conical—Weight Cwt. 1-2-7-8.
3 Bengal pattern gomer chambered Mortar, 2 inches shorter than Madras conical Weight—Cwt. 1-1-10.

Report of Experimental Practice with the undermentioned Brass and Iron 9 Pdr. Gu
5 rounds were fired against a Target 6 feet by 8 at 600 yards distance, to dete
Battery to the River was 1900 yards, and to the new Butt 2000 yards.

	Ordinary Brass 9 Pdr.											Major Oakes' Wrought Ir								
	Charge.		Elevation.		Recoil.		Flight.		Distance to 1st Graze.		Extreme Range.	Charge.		Elevation.		Recoil.		Flight.		Di 1s
									Real.	Medium.										Real.
Rounds.	lbs.	ozs.	D.	M.	feet.	ins.	S.	P.	yds.	yds.		lbs.	ozs.	D.	M.	feet.	ins.	S.	P.	yds.
1	2	4	P.	B.	6	9	1	...	530	497	Right Bank of River.	2	4	P.	B.	8	...	1	...	56
2	...	...	P.	B.	7	...	1	...	560		In the River.	...	...	P.	B.	7	6	1	...	55
3	...	...	P.	B.	7	3	1	...	402		Struck and lodged at 1500 yards.	...	...	P.	B.	7	6	1	...	40
1	...	...	1	...	7	...	3	...	958	915	In the River.	...	...	1	...	7	6	3	...	84
2	...	...	1	...	7	...	3	...	938		220 yards beyond River.	...	...	1	...	7	9	3	...	87
3	...	...	1	...	7	...	3	...	850		Struck and lodged at 900 yards.	...	...	1	...	7	2	2	30	85
1	...	...	2	...	7	...	3	30	1072	1135	Lodged in New Butt.	...	...	2	...	7	11	3	...	107
2	...	...	2	...	7	3	4	...	1152		350 yards beyond River.	...	...	2	...	7	10	3	30	113
3	...	...	2	...	7	6	4	...	1182		220 do. do.	...	...	2	...	7	8	4	...	119
1	...	...	3	...	6	...	4	...	1256	1522	400 do. do.	...	...	3	...	9	...	5	...	159
2	...	...	3	...	6	...	...	...	1900		100 do. do,	...	...	3	...	7	...	...	...	230
3	...	...	3	...	7	...	5	...	1410		420 do. do.	...	...	3	...	8	...	5	...	148
1	...	...	4	...	7	...	...	...	1674	1628	Lodged in New Butt.	...	...	4	...	7	9	5	...	146
2	...	...	4	...	7	...	5	...	1419		do. do.	...	...	4	...	7	...	5	...	147
3	...	...	4	...	7	4	...	...	1792		450 yards beyond River.	...	...	4	...	7	6	...	...	207
											The following 5 rounds at a Target									
1	2	4	...	45	6						Grazed 17 yards in front and thro' bottom of Target.	2	4	...	45	8	...	over and		
2	...	...	..	30	7						,, 8 ,, ,, ,, ,, ,,	...	...	...	30	8	9	262 yards		
3	...	...	...	45	8						,, 120 ,, ,, black ring of Target.	...	...	...	45	9	...	48 ,,		
4	...	...	...	53	8						,, 202 in front.	...	...	1	...	9	...	Through T		
5	...	...	...	53	8						,, 25 ,,	...	...	1	...	9	...	Lodged in		

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carried on at Artillery Head Quarters on the 26th and 28th March 1855. The last

aine the accuracy of each piece when fired at a given object. The distance from the

n 9 Pdr.			Brass 9 Pdr. Reamer.										
tance to Graze.		Extreme Range.	Charge.		Elevation.		Recoil.		Flight.		Distance to 1st graze.		Extreme Range.
	Medium.										Real.	Medium.	
	yds.		lbs.	ozs.	D.	M.	feet.	ins.	S.	P.	yds.	yds.	
3	506	200 yards beyond River.	1	14	P.	B.	5	8	1	...	584	495	250 yards beyond River.
0		220 yards do.	1	12	P.	B.	5	4	1	...	512		Struck at 1650 yards and lodged.
4		In the River.	1	10	P.	B.	5	...	1	...	388		Lodged in New Butt.
8	859	Struck and lodged at 1450 yards.	1	12	1	..	5	4	3	...	786	812	In the River.
8		Right Bank of River.	1	12	1	...	5	4	3	...	825		150 yards beyond River.
0		In the River.	1	12	1	...	5	1	3	...	825		Left Bank of River.
3	1133	Lodged in New Butt.	1	12	2	...	5	4	4	...	1000	983	Lodged in New Butt.
5		200 yards beyond River.	1	12	2	...	5	6	4	...	1036		Right Bank of River.
2		Lodged in New Butt.	1	12	2	...	5	6	3	30	912		Left Bank of River.
7	1793	120 yards beyond River.	1	12	3	...	3	3	4	...	1046	1131	50 yards beyond River.
0		600 do. do.	1	12	3	...	3	...	4	30	1170		320 do. do.
2		110 do. do.	1	12	3	...	4	...	4	30	1178		50 do. do.
3	1668	In the River.	1	12	4	...	4	...	4	30	1212	1246	50 do. do.
0		100 yards beyond River.	1	12	4	...	4	...	4	30	1260		75 do. do.
0		450 do. do.	1	12	4	...	4	3	4	30	1266		In the River.
at 600 yards distance.													
lodged in Butt.			1	12	...	45	4	...	Through bottom of Target.				
in frot.			...	...	...	30	4	6	250 yards in front and through Target.				
„ and over.			...	...	1	...	4	3	Through Target.				
Target.			...	...	1	...	4	...	146 yards in front.				
in curtain to the right.			...	...	1	...	4	9	58 „ „				

Siege Operations before Brigadier T. E. Williams, Commanding the Nagpore Force, 15th February 1855.

Communicated by Major J. W. Croggan, Commanding Artillery Nagpore Force. PLATE I.

1. The chief efforts of the Artillery had been directed to the central work (*C*) in which a practical breach had been made; shot and shells from the enfilading battery had also been thrown along the right face (*b*) looking towards the place, and shells from the mortar battery had been thrown with some success at several objects within the place.

2. In the meantime the enemy had strengthened the place by throwing up the field work (*d*) and completing the face (*e*) by which the space in front of the breach was completely flanked, a wooden barrier (*m*) had also been hastily erected in front of the breach.

3. As a final effort to bring the operations of the siege to a conclusion, the following arrangements were made.

Batteries.	Ordnance.	Remarks.
No. 1. Breaching.	2-18 Pdr. Iron Guns. 2-12 Pdr. Iron Guns.	To throw hot shot into the barrier covering the breach (*C*) at 600 yards.
No. 2. Mortar.	3-8 inch Iron Mortars. 1-5½ in. brass Mortar.	To blow up the Enemy's Magazine at 700 yards (*a*).
No. 3. Enfilading.	1-8 in. Iron Howitzer. 3-24 Pdr Howitzers.	To enfilade the right face of the place (*b*) at 600 yards.
No. 4. Left Ricochet.	3-9 Pdr. Brass Guns. 1-24 Pdr. Howitzer.	To ricochet the face (*d*) flanking the breach—Distance 400 yards.
No. 5. Right Ricochet.	2-12 Pdr. Howitzer. 2-5½ in. Brass Mortars.	To ricochet the face (*e*) flanking the breach—Distance 450 yards for Howitzers, 490 yards to the Magazine for Mortars.
No. 6. D. Troop H. Arty.	4-6 Pdr. Brass Guns.	The Detachment and available men to act both as Horse Artillery and Cavalry as circumstance might require.
No. 7. Light Field Battery. Foot Artillery.	4-9 Pdr. Brass Guns.	Moveable as required—Detachments ready to act as Infantry.

4. To distract the attention of the enemy the fire of these several batteries was arranged as follows.

Order of Firing.	Number of Rounds.	Batteries.	Remarks.
1st	One.	Mortars.	
2nd	One.	Enfilading.	
3rd	Two.	Breaching.	In succession as follows. 1 Round Breaching. 1 Right Ricochet. 1 Left Ricochet. 1 Breaching & soforth.
	Two.	Right Ricochêt.	
	Two.	Left Ricochêt.	

5. The Horse Artillery and Light Field Battery moved obliquely to the right front, the former at a distance (*g*) of 300 yards, and the latter at (*h*) 900 yards from a supposed body of the enemy (*f*) and fired each two rounds of spherical case shot, after which they retired in succession to their original positions.

6. The Heavy Batteries resumed their fire as follows:—

Order of Firing.	Number of Rounds.	Batteries.	Remarks.
4th	One.	Mortars.	
5th	One.	Enfilading.	
6th	Three.	Breaching.	In succession as follows. 1 Round Breaching. 1 Right Ricochet. 1 Left Ricochet. 1 Breaching and so forth.
	Three.	Right Ricochêt.	
	Three.	Left Ricochêt.	
7th	One.	Mortars.	
8th	One.	Enfilading.	

7. The Horse Artillery and Light Field Battery advanced and formed at 500 yards (*i*) from the place and fired one round of round shot to the breach. The Horse Artillery as Cavalry charged along the front of the place. The batteries then advanced to within 20 yards and fired four rounds of Canister.

8. The Magazine having exploded and the wooden barrier in front of the breach being on fire, all the available men from the several batteries formed in rear of the light field batteries as infantry (*l*) in close column, together with Gun Lascars with their light pioneer tools.

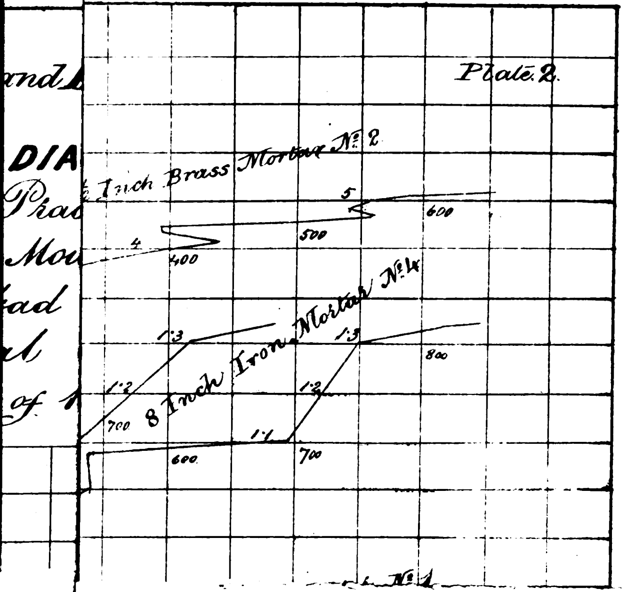
9. A body of Artillery men, as light infantry extended themselves along the front of the place (*l*) and a Serjeant and two men were sent to the gate way (*m*) with a leather bag containing 60 lbs. of powder.

10. After a short pause the bag exploded, completely demolishing the gate although strengthened by a mound of earth in the rear.

11. The assaulting party now advanced at the double pace, crossed the ditch, and ascended the breach, filing off below into the place, and the horse artillery as cavalry (*n*) charged round the place to cut off the enemy's retreat.

KAMPTEE, 1855. (Signed.) J. W. CROGGAN, Major,
late Commanding Artillery,
Nagpore Force.

Plate. 2.


Inch Brass Mortar No. 2
4
5
400
500
600
8 Inch Iron Mortar No. 4
1·3
1·2
1·1
1·3
1·2
700
600
700
800
No. 1

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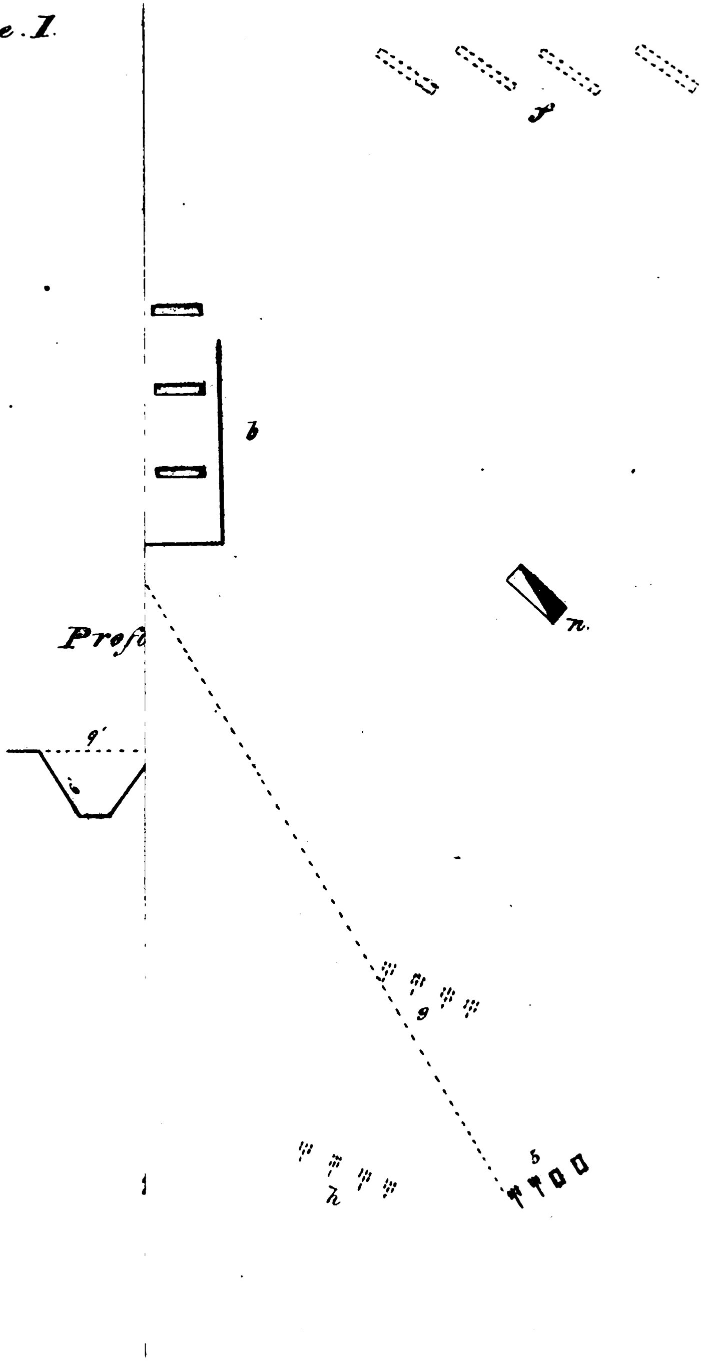

Practice with Oblong (Col. Cullen's) and Common Shells from 8 inch Mortars, extracted from the Madras Artillery Select Committee Proceedings. Meeting 69, Article 193, Dated 7th June 1833. Plate 3.

Dimensions of Mortars and Shells.

	MORTAR.						BED.			BORE.						CHAMBER.								DISTANCE FROM SHELL TO MUZZLE.				SHELL.										
												Diameter.						Diameter.											Common.				Col. Cullen's.					
	Weight.			Length.			Weight.			Length.		Horizontal.		Vertical.		Length.		Horizontal.		Vertical.		Contents.	Shape.	Common Shell.		Col. Cullen's Shell.		Number.	Diameter.		Weight.		Diameter.		Length.		Weight.	
	cwts.	qrs.	ths.	feet.	ins.	ths.	cwts.	qrs.	lbs.	ins.	ten.	ins.	ten.	ins.	ten.	ins.	ten.	ins.	ten.	ins.	ten.	lbs.		ins.	ten.	ins.	ten.		ins.	ten.	lbs.	ozs.	ins.	ten.	ins.	ten.	lbs.	ozs.
8 Inch Iron................	8	2	4	1	10	8	8	0	7	8	1	8	1	8	1	8	0	8	1	8	1	2¼	Gomer.	4	4·5	1	7	1	7	7·9	48	0	7	8·5	9	3	67	10
																												2	0	0	0	0	7	9	9	5·5	69	4
8 „ Brass No. 1........	6	0	11	2	1	8	7	3	26	13	3	8	·8	8	·78	7	5	4	1·8	4	2	2¼	Conical.	6	· 1	3	8	3	0	0	0	0	7	7·5	9	4	66	0
																												4	0	0	0	0	7	7·5	9	4	61	10
8 „ „ „ 2.......	6	0	4	2	1	6	9	2	7	13	2	8	·2	8	·2	7	2	4	1	4	1	2¼	Do.	5	9	3	2·5	5	0	0	0	0	0	0	0	0	0	0
																												6	0	0	0	0	0	0	0	0	0	0

Comparative Ranges with the Common Shells and Lieutenant Colonel Cullen's Oblong Shells.

	Charge.			Weight of Shell.			Flight.			Range.						Distance.				How fell.			Pene-tration.			Remarks.
										1st round.		2d round.		3d round.		Real.										
				1st Round.	2d "	3d "	1st Round.	2d "	3d "	Right.	Left.	Right.	Left.	Right.	Left.	1st round.	2d "	3d "	Medium.	1st round.	2d "	3d "	1st round.	2d "	3d "	
	lbs.	ozs.	drs.	lbs.	lbs.	lbs.	sec.	sec.	sec.	yds.	yds.	yds.	yds.	yds.	yds.	yds	yds.	yds.	yds.				ins.	ins.	ins.	
Iron..........	1	5	0	67⅝	69¼	66	13	11¾	12	0	50	0	34	25	0	675	611	649	645	side.	down.	up.	3	8	10	Col. Cullen's Shells.
Brass 1.......	0	13	0	48	48	48	11	11¾	11½	0	40	15	0	0	10	630	675	650	651							
Brass 2.......	0	13	0	48	48	48	13	13	12¾	0	37	15	0	20	0	765	784	780	776							
Oakum. Iron......	1	5	0	67⅝	69¼	66	13	12¾	12¼	0	20	0	14	10	0	695	680	666	680	up.	down.	down.	10	4	6	Col. Cullen's Shells.
Brass 1...	0	13	0	48	48	48	12½	13	13	8	0	23	0	16	0	650	646	683	659							
Brass 2...	0	13	0	48	48	48	13	14	13	8	0	20	0	26	0	670	727	692	696							
Iron..........	1	6	0	66	69¼	61⅝	12	11¾	12½	15	0	9	0	0	9	675	637	758	690	side.	up.	up.	6	7	6	Col. Cullen's Shells.
Brass 1.......	0	14	0	48	48	48	12	12	13	0	20	0	11	16	0	764	790	815	789							
Brass 2.......	0	13	0	48	48	48	12	12	13¼	0	25	0	10	17	0	720	754	850	741							
Oakum. Iron......	1	6	0	67⅝	66	61⅝	12½	12¾	13	0	12	19	0	0	1	680	731	808	739	side.	down.	up.	7	8	10	Col. Cullen's Shells.
Brass 1...	0	14	0	48	48	48	13	12½	12¾	0	15	0	20	0	19	815	784	790	796							
Brass 2...	0	13	0	48	48	48	12¾	13	13	0	60	0	40	0	22	780	818	799	799							
Iron..........	1	7	8	69¼	67⅝	61⅝	12½	13	13	0	5	0	20	31	0	758	804	800	787	down.	up.	up.	7	12	6	Col. Cullen's Shells.
Brass 1.......	0	15	3	48	48	48	13½	13½	13½	0	15	0	61	0	59	893	915	889	899							
Brass 2.......	0	15	3	48	48	48	14	14½	15	0	49	0	72	120	0	967	1060	1147	1055							
Oakum. Iron......	1	6	8	48	48	48	14½	12½	12½	0	50	25	0	20	0	1060	1050	....	1055							
Brass 1...	0	15	3	66	69¼	67⅝	11½	10¾	11	10	0	20	0	28	0	600	580	590	590	side.	down.	side.	8	14	7	Col. Cullen's Shells.
Brass 2...	0	15	3	48	48	48	15½	15	15	¼	0	0	50	0	2	1170	1150	1120	1146							
Iron..........	1	5	0	48	48	48	13	13	13	5	0	18	0	27	0	838	856	816	836							
Brass 1.......	1	3	8	69¼	66	61⅝	13½	13½	14	23	0	40	0	21	0	849	848	852	849	up.	down.	up.	15	14	8	Col. Cullen's Shells.
Brass 2.......	0	13	8	48	48	48	13½	14	13½	20	0	26	0	0	21	920	930	900	919							

Oakum. Iron……	1	5	0	48	48	48	14	13	14	0	2	62	0	0	52	1010	973	1002	995							
Brass 1…	1	3	8	67⅝	61⅝	66	13	13	13	11	0	21	0	0	20	802	822	823	815	up.	side.	down.	18	9	21	Col. Cullen's Shells.
Brass 2…	0	13	8	48	48	48	13	14	14	23	0	0	18	36	0	875	964	954	931							
Iron…………	1	6	8	48	48	48	13¼	13½	13¼	31	0	0	12	0	7	965	1009	1001	991							
Brass 1…….	1	6	0	69¼	67⅝	61⅝	13½	14	14	0	23	15	0	0	9	842	938	934	904	up.	down.	up.	24	13	8	Col. Cullen's Shells.
Brass 2…….	0	15	3	48	48	48	13½	14	13½	25	0	37	0	0	36	975	1055	1010	1013							
Oakum. Iron……	1	6	8	48	48	48	13½	14½	13½	0	26	0	21	0	17	995	1021	999	1005							
Brass 1…	1	6	0	69¼	67⅝	66	14	14½	14½	23	0	3	0	0	21	982	1001	1024	1002	side.	side.	down.	7	9	13	Col. Cullen's Shells.
Brass 2…	0	15	3	48	48	48	14½	15	15	0	16	26	0	0	70	1006	1096	1089	1063							
Iron…………	1	11	0	48	48	48	15	15	14¾	31	0	0	20	0	17	1035	1160	1097	1130	up.	down.	down.	12	6	12	
Brass 1…….	1	3	8	48	48	48	15	14¾	14¾	0	41	0	21	0	50	1171	1120	1091	1124	up.	down.	down.	6	6	10	
Brass 2…….	1	3	8	66	61⅝	69¼	14	14½	14	5	0	28	0	0	21	917	981	876	924	up.	side.	side.	9½	8	5	Col. Cullen's Shells.
Oakum. Iron……	1	11	0	48	48	48	16	16	15½	0	15	0	26	0	30	1320	1296	1209	1275	up.	up.	side.	15	18	12	
Brass 1…	1	3	8	48	48	48	15½	16½	15½	7	0	13	0	9	0	1296	1335	1240	1290	side.	down.	up.	14	15	11	
Brass 2…	1	3	8	67⅝	61⅝	66	14	14	14	11	0	0	20	0	15	984	1017	1004	1001	up.	up.	side.	13½	10	7	Col. Cullen's Shells.
Iron…………	1	12	0	48	48	48	15	15	15	47	0	0	32	5	0	1192	1182	1197	1190	up.	down.	side.	15	14	10	
Brass 1…….	1	4	0	48	48	48	16	16	15½	35	0	0	17	55	0	1325	1318	1290	1311	down.	side.	down.	11	13	9	
Brass 2…….	1	6	0	69¼	61⅝	67⅝	14	15	14	17	0	0	31	23	0	872	1011	998	962	down.	side.	down.	10	7	17	Col. Cullen's Shells.
Oakum. Iron……	1	12	0	48	48	48	16	17	17	31	0	0	54	0	29	1492	1541	1503	1512	down.	up.	up.	16	15	16	
Brass 1…	1	4	0	48	48	48	16	16	16	32	0	47	0	67	0	1379	1409	1343	1377	up.	down.	up.	9	10	14	
Brass 2…	1	6	0	67⅝	69¼	66	14½	15	15	29	0	7	0	41	0	1027	1115	1132	1091	up.	up.	down.	10	11	14	Col. Cullen's Shells.
Iron…………	1	13	0	48	48	48	15½	16¼	15¾	0	50	0	30	60	0	1270	1425	1250	1315	up.	side.	up.	10	14	11	
Brass 1…….	1	4	0	48	48	48	15½	15½	16	0	30	10	0	0	50	1266	1240	1300	1268	down.	up.	down.	17	12	11	
Brass 2…….	1	8	0	66	69¼	61⅝	15½	15½	16	0	7	0	37	34	0	1172	1143	1242	1189	up.	up.	down.	18	15	17½	Col. Cullen's Shells.
Oakum. Iron……	1	13	0	48	48	48	16	16	17	0	53	0	89	0	47	1375	1378	1485	1412	up.	side.	down.	15	17	13	
Brass 1…	1	4	0	48	48	48	16	16	15½	9	0	0	13	0	51	1330	1306	1254	1300	down.	up.	side.	18	16	14	
Brass 2…	1	8	0	61⅝	67⅝	66	16	16	16	0	32	0	3	0	51	1253	1201	1205	1219	down.	side.	side.	29	24	22½	Col. Cullen's Shells.
Brass 2…..	1	11	0	61⅝	66	67½	17¼	17	17	21	0	0	34	9	0	1360	1394	1310	1354	side.	up.	down.	24	27	30	Col.Cullen'sShells.
	1	12	12	67½	61⅝	69¼	17¼	18	17	0	31	0	47	0	52	1402	1448	1376	1468	side.	side.	up.	29	31	28	
	1	15	0	61⅝	66	69¼	17¼	18	18	0	58	0	112	0	68	1511	1503	1467	1493	down.	down.	side.	36	34	29	
	2	2	0	66	69¼	67⅝	18½	19	18½	0	21	0	93	0	10	1527	1572	1493	1564	up.	up.	down.	36	29	33	

The following is extracted, shewing at one view the distance from the object with both kind of Shells, with ranges that approximate nearest each other.

	Col. Cullen's Shells.							Common Shells.								
	From the object.			Range.	Penetration.			From the object.			Range.	Penetration.			Range.	
	1st round.	2d "	3d "		1st round.	2d "	3d "	1st round.	2d "	3d "		1st round.	2d "	3d "		
	yds.	yds.	yds.	yards.	ins.	ins.	ins.	yds.	yds.	yds.	yards.	ins.	ins.	ins.	yards.	
8 Inch Iron Mortar......	50	34	25	645	3	8	10	50	25	20	1055	12	6	12	1130	The penetrations were not taken with the Common Sheils till near the end of Practice, they are here given, but with different ranges from the comparative ones.
	20	14	10	680	10	4	6	5	18	27	836	6	6	10	1124	
	15	9	9	690	6	7	6	2	62	52	995	15	8	12	1275	
	12	19	1	739	7	8	10	31	12	7	991	14	15	11	1290	
	5	20	31	787	7	12	6	26	21	17	1005	15	14	10	1190	
8 Inch Brass Mortar No. 1.	10	20	28	590	8	14	7	40	15	10	651	11	13	9	1311	
	23	40	21	849	15	14	8	20	11	16	789	16	15	16	1512	
	11	21	20	815	18	9	21	15	20	19	796	9	10	14	1377	
	23	15	9	904	24	13	8	15	61	59	899	10	14	11	1315	
	23	3	21	1002	7	9	13	.	.	.	.	17	12	11	1268	
8 Inch Brass Mortar No. 2.	5	28	21	924	9½	8	5	20	26	21	919	15	17	13	1412	
	11	20	15	1001	13½	10	7	25	37	36	1013	18	16	14	1300	
	17	31	23	962	10	7	17	23	18	36	931	.	.	.	.	
	29	7	41	1091	10	11	14	16	26	70	1063	.	.	.	.	
	7	37	34	1189	18	15	17½	¼	50	2	1146	.	.	.	.	
	32	3	51	1219	29	24	22½	Carcasses from the other Mortars till the end of Practice.								
	21	34	9	1354	24	27	30									
	31	47	52	1376	29	31	28									
	58	112	68	1493	36	34	29									
	21	93	10	1564	36	29	33									

8 Inch Iron Mortar.

No fair comparison can be formed with the 8 Inch Iron Mortar the ranges differ so much, the Oblong shells being fired five days from it and then the Globular, the range daily increasing.

8 Inch Brass Mortar Nos. 1 and 2.

In both these a very fair estimate may be formed of the Flight of both kind of Shells, as the Medium ranges do not differ very much.

Penetration into the earth.

The penetrations of the Oblong Shells were taken throughout the Practice.—Of the others only from the 11th day, they are given, but with different ranges from those used in comparing the steadiness of the flight of the projectiles, still some comparison may be made, the ground however, differs so much in quality that no very satisfactory result can be expected.

Position of the Fuze when the shells grounded.

By examning the Table it appears that with the Oblong Shells out of 60 fired.

Fell on their sides...18
Fuze upwards.......23
Fuze downwards...19

Of the Common shells out of 36 fired.

Fell on their sides... 7
Fuze upwards........15
Fuze downwards...14

the position of the Fuzes on coming to the ground was not taken with the Common Shells until the 11th day's Practice, with the Oblong Shells throughout the Practice.*

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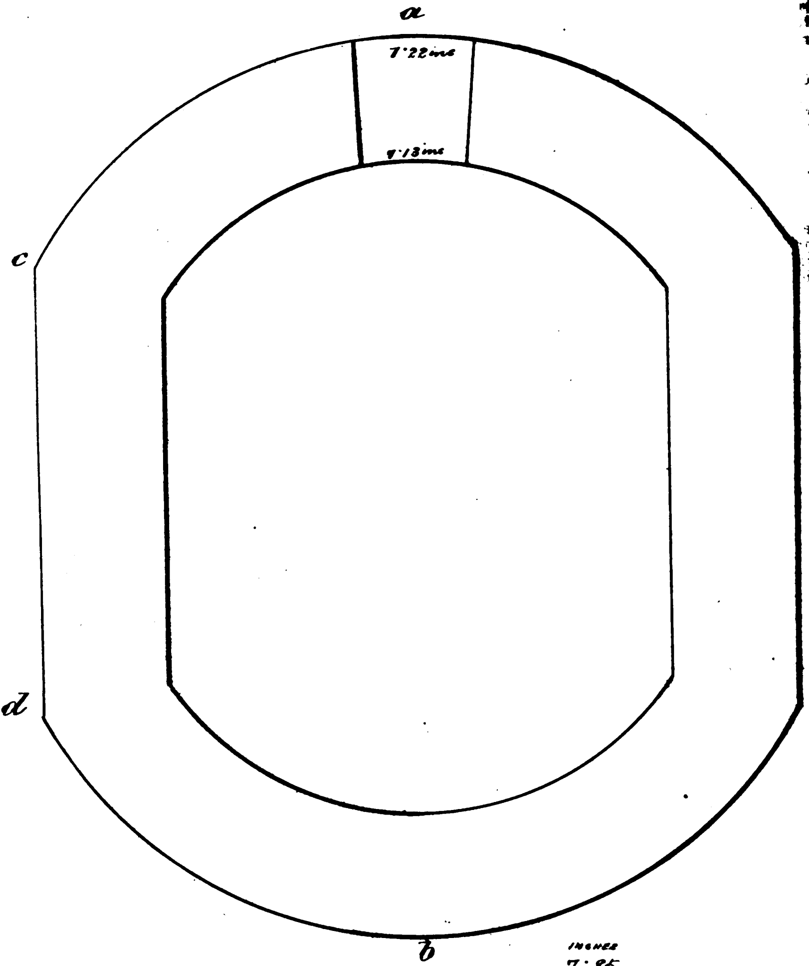
* No further experiments with Oblong Shells have taken place up to this date.—15th September 1855. (Acting D. A. D.)

Practice and Experiments.

Oblong Shells

proposed by Lieut. Col. Cullen.

8 Inch.

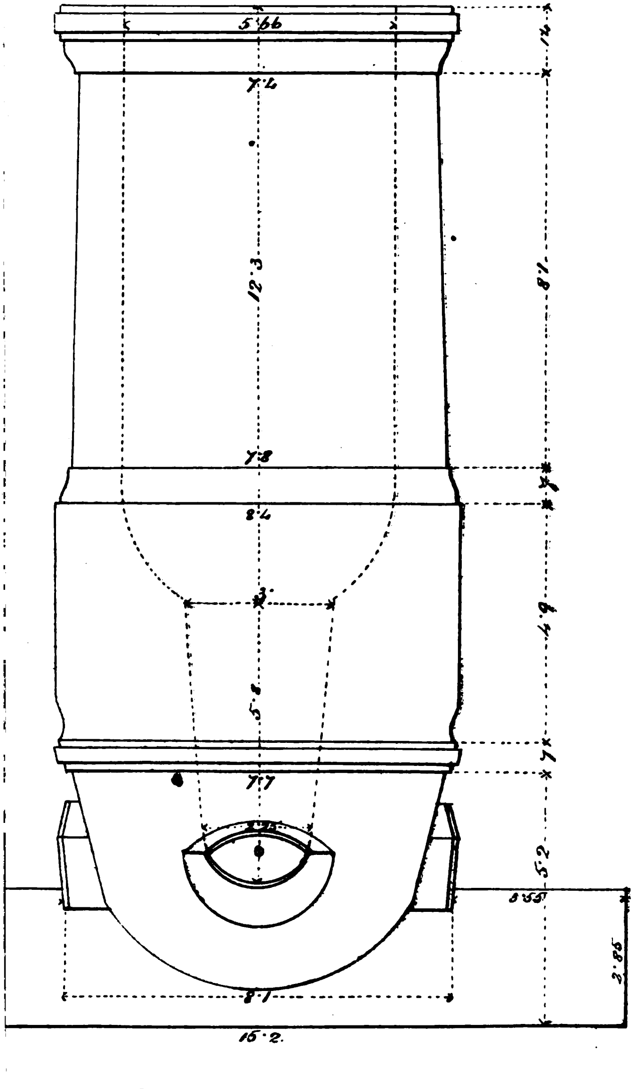


	INCHES
DIAMETER	7·85
LENGTH – a, b,	9·5
— " — c, d	4·75
THICKNESS of METAL	1·3

MADRAS M
AT THE C

MADRAS MORTAR EXPERIMENTAL CAST AT THE GUN CARRIAGE MANUFACTORY.

WEIGHT 199¾ lbs.



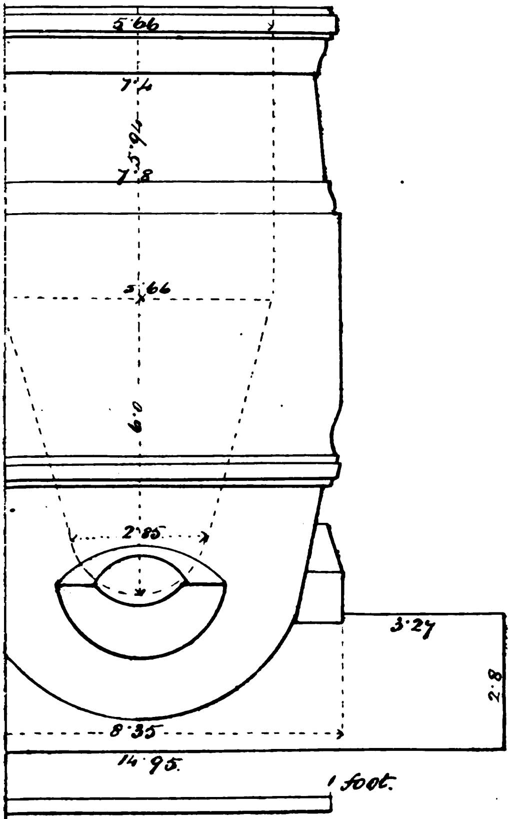
H. J. Kouwen. Lithogr.

Plate 5.

ments.

NGAL MORTAR SHORT
VITH GOMER CHAMBER.

WEIGHT 148 lbs.



H.J. Kouwen Lithogr.

Series of Experiments carried on at Saint Thomas' Mount to test the powers and character of the several 5½ inch Brass Mortars of the old service pattern, as well as the Experimental Mortars, placed at the disposal of the Director of the Artillery Depot of Instruction, for that purpose. Plates 4 and 5.

DIMENSIONS AND WEIGHT OF THE SEVERAL 5½ INCH BRASS MORTARS USED IN THE FOLLOWING SERIES OF EXPERIMENTAL PRACTICE.

	No. 1, Madras Mortar with Conical Chamber, G. Hutchinson, Fort William, 1833, No. 75.	No. 2, Bengal Mortar short with Gomer Chamber, P. S. C. Cossipore, 1852, No. 13	No. 3, Bengal Mortar Experimental long with Gomer Chamber, Cossipore 1853, No. 1.	No. 4, Madras Conical Chamber reamed up to Gomer Chamber, G. Hutchinson, Fort William, 1833, No. 64.	No. 5, Madras Mortar Experimental cast at the Gun Carriage Manufactory J. M. 1855, Gun Carriage Manufactory.
	lbs.	lbs.	lbs.	lbs.	lbs.
Weight of the piece..................	196	148	175½	188	199¾
	inches.	inches.	inches.	inches.	inches.
Length of ,, ...	16·9	15·05	19·05	16·9	21
,, Trunnions	2·2	3·27	3·5	2·2	3·55
Breadth between the outer extremities of the Trunnions	12·5	14·95	14·95	12·5	15·2
Diameter of Trunnions from shoulder to shoulder.....................	8·15	8·35	8·175	8·15	8·1
Diameter of Trunnions	2·70	2·80	2·81	2·70	2·85
,, of Bore Horizontal	5·62	5·66	5·66	5·62	5·66
,, of ,, Vertical	5·62	5·66	5·66	5·62	5·66
Length of the Bore to commencement of Chamber	7·83	5·94	10·0	6·8	12·3
Length of Chamber..................	5·17	6·0	5·9	6·2	5·8
Length of Bore from muzzle to bottom of Chamber................	13·0	11·94	15·90	13·0	18·1
Diameter of Chamber superior.....	2·75	5·66	5·66	5·62	3·0
,, of ,, inferior	1·8	2·85	3·1	2·7	2·25
Distance from Shell when placed in Mortar to muzzle of piece....	2·70	3·5	7·25	3·5	7·3

1839.

Ranges obtained with Conical and Gomer 5½ Inch Mortars, at Experiments carried on by the Permanent Artillery Select Committee in 1839.

No. of Rounds.	Charge.		Conical.				Gomer.			
			Range.		Distance.	Greatest difference.	Range.		Distance.	Greatest difference.
			Right.	Left.			Right.	Left.		
	ozs.	drs.	yards.	yards.	yards.	yards.	yards.	yards.	yards.	yards.
1	2	0	0	3	200	42	0	2	132	20
2	0	0	0	4	162		0	2	136	
3	0	0	2	0	204		0	2	145	
4	0	0	0	6	198		0	2	145	
5	0	0	0	4	189		0	4	150	
6	0	0	0	3	168		0	1	152	
1	2	4	0	1	212	28	0	6	147	15
2	0	0	1	0	196		0	2	146	
3	0	0	3	0	204		0	2	155	
4	0	0	li	ne	218		0	4	140	
5	0	0	1	0	219		0	4	144	
6	0	0	2	0	224		0	2	152	
1	2	8	0	1	244	19	0	3	180	13
2	0	0	0	1	228		0	3	176	
3	0	0	0	3	247		li	ne	185	
4	0	0	0	3	231		0	½	189	
5	0	0	0	4	240		li	ne	178	
6	0	0	0	1	230		0	1	187	
1	2	12	0	2	268	36	3	0	189	28
2	0	0	0	4	244		0	7	191	
3	0	0	0	3	252		0	8	217	
4	0	0	0	2	280		li	ne	208	
5	0	0	0	6	276		0	4	203	
6	0	0	0	3	256		0	2	204	
1	3	0	2	0	297	71	0	2	228	22
2	0	0	li	ne	304		li	ne	221	
3	0	0	li	ne	292		0	4	236	
4	0	0	3	0	290		li	ne	233	
5	0	0	li	ne	361		li	ne	239	
6	0	0	1	0	316		½	0	217	
1	3	4	3	0	360	66	0	4	232	42
2	0	0	4	0	347		0	5	242	
3	0	0	6	0	376		li	ne	261	
4	0	0	5	0	368		0	6	251	
5	0	0	0	5	345		0	4	248	
6	0	0	6	0	310		4	0	219	
1	3	8	li	ne	344	83	0	5	256	27
2	0	0	11	0	418		0	3	261	
3	0	0	0	2	400		0	6	270	
4	0	0	11	0	427		0	1	253	
5	0	0	10	0	377		1	0	258	
6	0	0	8	0	386		0	2	280	

1839.

(Continued.)

No. of Rounds.	Charge.		Conical.				Gomer.			
			Range.		Distance.	Greatest difference.	Range.		Distance.	Greatest difference.
			Right.	Left.			Right.	Left.		
	ozs.	drs.	yards.	yards.	yards.	yards.	yards.	yards.	yards.	yards.
1	3	12	7	0	440	60	0	½	258	30
2	0	0	4	0	476		li	ne	240	
3	0	0	6	0	452		0	6	251	
4	0	0	6	0	467		0	3	270	
5	0	0	4	0	500		2	0	264	
6	0	0	16	0	476		3	0	254	
1	4	0	li	ne	537	60	0	14	259	51
2	0	0	16	0	546		0	9	295	
3	0	0	6	0	508		0	17	292	
4	0	0	0	8	490		0	8	310	
5	0	0	3	0	550		0	4	296	
6	0	0	4	0	496		3	0	291	
1	4	4	22	0	533	129	0	16	309	35
2	0	0	15	0	570		li	ne	334	
3	0	0	8	0	561		0	2	315	
4	0	0	23	0	662		li	ne	314	
5	0	0	0	2	568		0	18	340	
6	0	0	17	0	620		0	½	342	
1	4	8	11	0	610	84	li	ne	364	25
2	0	0	6	0	620		0	12	367	
3	0	0	0	3	622		1	0	343	
4	0	0	2	0	694		li	ne	342	
5	0	0	0	6	655		0	9	361	
6	0	0	8	0	671		li	ne	346	
1	4	12	9	0	624	120	4	0	398	50
2	0	0	28	0	655		li	ne	378	
3	0	0	23	0	731		0	8	348	
4	0	0	9	0	700		0	2	390	
5	0	0	22	0	744		8	0	379	
6	0	0	10	0	650		0	4	365	
1	5	0	30	0	836	77	0	19	344	66
2	0	0	7	0	776		0	8	397	
3	0	0	30	0	759		0	18	350	
4	0	0	25	0	778		16	0	410	
5	0	0	1	0	820		6	0	377	
6	0	0	40	0	805		0	4	348	
1	5	4	0	26	854	52	8	0	461	65
2	0	0	22	0	854		0	11	429	
3	0	0	0	7	894		li	ne	425	
4	0	0	4	0	842		0	13	480	
5	0	0	0	5	880		8	0	490	
5	0	0	0	18	850		11	0	484	

1839.

(Continued.)

No. of Rounds.	Charge.		Conical.				Gomer.			
			Range.		Distance.	Greatest difference.	Range.		Distance.	Greatest difference.
			Right.	Left.			Right.	Left.		
	ozs.	drs.	yards.	yards.	yards.	yards.	yards,	yards.	yards.	yards.
1	5	8	16	0	900	151	li	ne	452	37
2	0	0	0	21	961		0	5	440	
3	0	0	5	0	864		0	7	437	
4	0	0	0	20	863		0	12	458	
5	0	0	115	0	864		0	4	468	
6	0	0	0	10	1014		0	9	474	
1	5	12	110	0	1020	118	0	2	500	124
2	0	0	40	0	1022		6	0	501	
3	0	0	0	3	1060		0	11	410	
4	0	0	0	3	981		0	23	412	
5	0	0	20	0	942		0	8	534	
6	0	0	38	0	1038		6	0	458	
1	6	0	60	0	1077	161	0	6	467	50
2	0	6	0	42	993		0	24	506	
3	0	0	0	59	1111		0	16	460	
4	0	0	li	ne	1030		0	10	465	
5	0	0	40	0	950		11	0	505	
6	0	0	46	0	970		2	0	510	
1	6	4	20	0	1135	62	12	0	557	39
2	0	0	23	0	1100		0	14	546	
3	0	0	59	0	1129		16	0	537	
4	0	0	0	9	1110		0	29	561	
5	0	0	0	27	1084		0	28	572	
6	0	0	0	34	1073		0	28	576	
1	6	8	0	53	1121	76	1	0	535	45
2	0	0	0	23	1197		27	0	570	
3	0	0	0	30	1145		li	ne	588	
4	0	0	20	0	1166		0	1	534	
5	0	0	0	20	1150		3	0	586	
6	0	0	36	0	1194		0	10	568	
1	6	12	60	0	1185	149	1½	0	647	105
2	0	0	100	0	1118		0	20	613	
3	0	0	160	0	1225		0	15	603	
4	0	0	0	22	1243		0	17	653	
5	0	0	0	10	1094		8	0	658	
6	0	0	62	0	1095		li	ne	636	
1	7	0	43	0	1217	171	1	0	567	96
2	0	0	29	0	1078		27	0	636	
3	0	0	35	0	1249		li	ne	600	
4	0	0	0	40	1150		22	0	612	
5	0	0	40	0	1186		0	20	587	
6	0	0	0	42	1153		16	0	597	

(Signed) **F. BLUNDELL, Major.**
Actg. Director Artillery Depot.

SEPTEMBER 1853.

Table shewing the comparative Ranges obtained with similar elevations and charges, from the Madras Conical (cast at Fort William) and Bengal Gomer chambered Mortars, (5½ Inch) at Experimental Practice carried on by the Permanent Artillery Select Committee in September 1853.

Charge.		Madras Conical.		Bengal Gomer.			Charge,		Madras Conical.		Bengal Gomer.		
		Range.		Range.					Range.		Range.		
		Real.	Medium.	Real.	Medium.				Real.	Medium.	Real.	Medium.	
ozs.	drs.	yards	yards.	yards.	yards.		ozs.	drs.	yards.	yards.	yards.	yards.	
2	...	190 *205 186 *207 182	186	*84 101 102 *96 98	100	Elevation 45°. New 5½ Inch Shell.	4	8	952 972 *902 968 *910	964	*202 209 210 *238 206	208	Elevation 45°. New 5½ Inch Shell.
2	4	243 243 *229 243 *253	243	106 *86 99 *123 108	104		4	12	955 *926 974 958 *982	962	*321 *242 290 271 267	276	
2	8	278 291 *315 284 *330	284	139 147 *84 124 *105	137		5	...	*1047 1015 1009 1022 not fd.	1015	266 270 *336 290 *319	274	
2	12	*444 401 401 *476 427	410	*132 111 109 *152 128	116		5	4	1072 1079 1089 *1112 *1098	1080	*357 308 307 308 *260	308	
3	...	*541 506 530 486 *455	507	134 133 130 *121 *143	132		5	8	1050 1046 1070 *1000 *1160	1055	*430 350 *500 390 376	372	
3	4	569 649 *484 599 *440	606	*125 *138 131 132 129	131		5	12	1180 *1096 *1100 1220 1200	1200	470 *404 454 *520 452	459	
3	8	679 659 638 *593 *553	659	154 *166 143 153 *141	150		6	...	1250 1240 1250 *1184 *1210	1247	*470 430 *560 450 440	440	
3	12	*834 *806 767 749 752	756	160 *148 *174 161 168	163		6	8	*1350 1340 *1225 1340 1344	1341	480 *550 510 490 *590	493	
4	...	798 *610 793 *818 776	789	*166 *189 177 171 176	175		7	...	1420 *1396 1420 *1125 1425	1422	550 560 520 *660 *610	543	
4	4	*823 *746 852 894 869	872	198 198 *202 *195 199	198								

* These ranges are not included in estimating the mean range; the three rounds approximating closest to each other have been taken to fix the average.

Windage minimised in the Gomer Chamber by construction.—Windage in Conical Chamber Mortar, ·05.

(Signed) G. W. Y. SIMPSON, Major,
Director Artillery Depot.

SEPTEMBER 1853.

Table shewing the comparative equability of proximate Ranges obtained from the Madras Conical and Bengal Gomer chambered Mortars (5½ Inch) at experiments carried on by the Permanent Artillery Select Committee in September **1853.**

Madras Conical.			Bengal Gomer.			Equability of Range in favor of
Range.		Greatest difference.	Range.		Greatest difference.	
Real.	Medium.		Real.	Medium.		
yards.	yards.	yards.	yards.	yards.	yards.	
190 *a* 205 186 *a* 207 182	186	25	198 198 *a* 202 *a* 195 199	198	7	Gomer.
243 243 *a* 229 243 *a* 253	243	24	262 270 *a* 336 290 *a* 319	274	74	Conical.
278 291 *a* 315 284 *a* 330	284	52	*a* 321 *a* 242 290 271 267	276	79	Conical.
a 443 401 401 *a* 476 427	410	75	400 *a* 320 410 391 *a* 354	400	90	Conical.
a 541 506 530 486 *a* 455	507	86	480 *a* 550 510 490 *a* 590	493	110	Conical,
679 659 638 *a* 593 *a* 553	659	126	*a* 620 640 670 670 *a* 750	660	130	Conical.
a 834 *a* 806 767 749 752	756	85	*a* 810 *a* 880 750 770 760	760	130	Conical.
798 *a* 610 793 *a* 818 776	789	208	*a* 850 770 800 *a* 700 760	777	150	Gomer.
a 823 *a* 746 852 894 869	872	148	*a* 850 *a* 1000 875 888 870	878	150	Conical.
952 972 *a* 902 968 *a* 910	964	70	*a* 900 *a* 892 964 958 983	968	91	Conical.
a 1047 1015 1009 1002 not found.	1015	43	*a* 942 *a* 930 1029 1048 1014	1030	118	Conical.

a These ranges are not included in estimating the mean range; the three rounds approximating closest to each other have been taken to fix the average.

(Signed) **G. W. Y. SIMPSON, Major,**
Director Artillery Depot.

SEPTEMBER 1853.

Table shewing the comparative Ranges obtained with similar elevations and charges, from the Madras and Bengal Gomer chambered Mortars, (5½ Inch) at Experiments carried on by the Permanent Artillery Select Committee in September 1853.

Charge.		Madras Gomer. Range.		Bengal Gomer. Range.		Charge,		Madras Gomer. Range.		Bengal Gomer. Range.		Remarks.
		Real.	Medium.	Real.	Medium.			Real.	Medium.	Real.	Medium.	
ozs.	drs.	yards.	yards.	yards.	yards.	ozs.	drs.	yards.	yards.	yards.	yards.	
2	...	a 171 144 145 142 x 134	144	a 84 101 102 a 96 98	100	4	8	389 388 a 374 388 a 391	388	a 202 209 210 a 238 206	208	*a* These ranges are not included in estimating the mean range; the three rounds approximating closest to each other have been taken to fix the average.
2	4	a 184 a 234 154 156 146	152	106 a 86 99 a 123 108	104	4	12	413 394 a 380 a 368 404	404	a 321 a 242 290 271 267	276	
2	8	188 a 149 172 a 158 182	181	139 147 a 84 124 a 105	137	5	...	424 430 420 a 454 a 447	425	262 270 a 336 290 a 319	274	
2	12	167 173 a 154 160 a 150	167	a 132 111 109 a 152 128	116	5	4	462 458 a 448 459 a 498	460	a 357 308 307 308 a 260	308	
3	...	207 199 a 173 a 188 203	203	134 133 130 a 121 a 143	132	5	8	506 a 516 a 516 500 499	502	a 430 350 a 500 390 376	372	
3	4	a 197 a 304 270 244 242	252	a 125 a 138 131 132 129	131	5	12	569 538 a 513 a 604 543	550	470 a 404 454 a 520 452	459	
3	8	a 312 274 254 250 a 316	259	154 a 166 143 153 a 141	150	6	...	a 612 641 558 552 a 631	583	a 470 430 a 560 450 440	440	
3	12	a 242 253 288 280 a 340	274	160 a 148 a 174 161 168	168	6	8	a 694 651 a 629 652 652	652	480 a 550 510 490 a 590	493	
4	...	a 368 348 a 396 332 327	336	a 166 a 189 177 171 176	175	7	...	704 a 801 704 a 725 724	711	550 560 520 a 660 a 610	543	
4	4	378 358 a 338 a 408 394	377	198 198 a 202 a 195 199	198	7	8	a 791 841 a 850 825 827	831	a 750 a 750 710 670 690	690	

SEPTEMBER 1853.

(Continued.)

Charge.		Madras Gomer.		Bengal Gomer.			Charge.		Madras Gomer.		Bengal Gomer.		Remarks.
		Range.		Range.					Range.		Range.		
		Real.	Medium.	Real.	Medium.				Real.	Medium.	Real.	Medium.	
ozs.	drs.	yards.	yards.	yards.	yards.		ozs.	drs.	yards.	yards.	yards.	yards,	
8	...	902 856 *a* 941 875 *a* 975	878	755 *a* 670 730 *a* 700 720	742		9	8	*a*1450 1260 *a*1125 1250 1275	1262	*a* 900 *a* 892 964 958 983	968	
8	8	1005 984 *a*1025 975 *a* 796	988	*a* 850 770 800 *a* 700 760	777		10	...	*a*1460 *a*1375 1450 1425 1420	1432	*a* 942 *a* 930 1029 1048 1014	1030	
9	...	*a*1002 *a*1084 1021 1049 1059	1043	*a* 850 *a*1000 875 888 870	878								

a These ranges are not included in estimating the mean range; the three rounds approximating closest to each other have been taken to fix the average.

The new 5½ Inch Shell was used throughout the Experiments.

(Signed) G. W. Y. SIMPSON, Major,
Director Artillery Depot.

SEPTEMBER 1854

Table shewing the Ranges obtained at 45° *Elevation with the lengthened* 5½ *Inch Gomer Chambered Brass Mortar recently received from Bengal, and the Madras* 5½ *Inch Conical Chambered Brass Mortar. The new* 5½ *Inch Shells were used for this Experimental Practice. The object in view being to ascertain the comparative steadiness and regularity of the two pieces at equal ranges.*

No. of Rounds.	NEW BENGAL GOMER.									MADRAS CONICAL.									Equability of Range in favor of
	Charge.		Flight.		Range.		Distance.		Greatest difference.	Choige.		Flight.		Range.		Distance.		Greatest difference.	
					Right.	Left.	Real.	Medium						Right.	Left.	Real.	Medium		
	ozs.	drs.	Sec.	Pts.	yds.	yds.	yds.	yds.	yds.	ozs.	drs.	Sec.	Pts.	yds.	yds.	yds.	yds.	yds.	
1	6	0	11	0	0	4	560	597	137	3	4	10	0	0	12	484	506	165	Gomer.
2			11	0	30	0	547					10	0	li	ne	435			
3			12	0	li	ne	684					11	0	0	4	600			
1	7	0	12	30	14	0	742	787	78	4	0	13	0	0	11	822	805	29	Conical.
2			13	0	5	0	820					13	0	11	0	800			
3			13	0	14	0	798					13	0	7	0	793			
1	8	0	15	30	0	16	1024	988	82	4	14	15	0	41	0	984	1009	60	Conical.
2			15	30	18	0	997					15	30	49	0	1044			
3			14	30	1	0	942					15	0	12	0	998			
1	9	0	17	0	0	8	1169	1159	25	5	10	17	0	0	174	1086	1127	74	Gomer.
2			16	0	6	0	1168					17	0	50	0	1160			
3			18	0	36	0	1141					17	0	27	0	1136			
1	10	0	19	0	0	32	1294	1308	25	6	7	18	0	37	0	1318	1341	82	Gomer.
2			19	0	19	0	1319					19	0	14	0	1392			
3			19	0	0	54	1312					18	0	0	55	1313			
1	11	0	19	0	0	14	1375	1419	93	7	0	20	0	0	42	1442	1401	74	Conical.
2			20	0	19	0	1468					19	0	0	23	1393			
3			20	0	0	106	1415					18	0	0	2	1368			
1	12	0	21	0	0	54	1568	1521	79	7	8	20	0	0	50	1450	1489	63	Conical.
2			20	0	27	0	1489					20	0	57	0	1504			
3			21	0	0	6	1505					22	0	100	0	1531			

6th October 1854.—The Gomer Chambered Mortar when fired with 8 ozs. Powder turned completely over, and struck the rear transom. This was afterwards obviated by passing a rope loosely over the chase of the Mortar, and securing the ends to the Elevating Screw Transom. The Mortar and Bed at subsequent firings made a clean jump from one end of the Platform to the other.

(Signed) G. ROWLANDSON Major,
Acting Divector Arty. Depot.

(Signed) G. CONRAN, Brigadier,
Commandant of Artillery.

ARTILLERY HEAD QUARTERS,
ARTILLERY DEPOT,
SAINT THOMAS' MOUNT,
7th September 1854.

SEPTEMBER 1854.

Table shewing the comparative Ranges obtained with similar Elevations and Charges from the Madras Conical, Madras Gomer, Short Bengal Gomer, and new Bengal Gomer Chambered 5½ Inch Brass Mortars.

No. of Rounds.	Charge.		Madras Conical.	Madras reamed upGomer	Short Bengal Gomer.	New Bengal Gomer Chamber.				Remarks.
						Flight.		Range.		
			Medium Range.	Medium Range.	Medium Range.			Real.	Medium.	
	ozs.	drs.	yards.	yards.	yards.	S.	P.	yds.	yds.	
1	2	0	186	144	100	5	15	166	165	
2						5	15	161		
3						5	30	169		
1	3	0	507	203	132	6	30	248	253	
2						6	30	246		
3						7	0	266		
1	4	0	789	336	175	8	0	305	338	
2						8	0	370		
3						8	0	338		
1	5	0	1015	425	274	10	0	498	459	
2						10	0	461		
3						9	30	420		
1	6	0	1247	583	440	12	0	658	672	
2						12	0	672		
3						12	15	686		
1	7	0	1422	711	543	13	0	839	844	
2						13	0	844		
3						13	15	848		

(Signed) G. ROWLANDSON, Major,
Acting Director Artillery Depot.

(Signed) G. CONRAN, Brigadier,
Commandant of Artillery.

ARTILLERY DEPOT,
ST. THOMAS' MOUNT,
27th September 1854.

MARCH 1855.

Table of Ranges with the undermentioned brass 5½ *inch Mortars, carried on at Artillery Head Quarters, under instructions from the Military Board in letter No.* 7148, *dated* 12*th February* 1855, *with* 6 *charges, varying from* 2½ *to* 10 *ozs. and at elevations with each charge of* 15°, 30°, 45°, *and* 60°.

Charge.	15° Elevation.									30° Elevation.									45° Elevation.									60° Elevation.								
	Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.			Madras Conical.			Bengal Gomer Long.			Bengal Gomer Short.		
	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.
Ozs.	S.	P.	yds.	S.	P.	yds	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.	S.	P.	yds.
2½	2	20	173	2	..	97	1	45	75	5	50	328	3	55	185	3	10	129	8	35	394	6	20	193	4	35	139	10	30	345	7	5	164	5	20	114
4	4	30	431	3	..	173	2	40	143	8	35	700	5	5	249	4	25	202	11	40	737	7	50	297	6	45	235	15	15	675	9	30	270	8	5	212
5½	5	20	584	3	30	280	3	..	226	10	30	891	6	45	440	6	15	372	13	45	1091	10	20	531	8	55	414	18	40	957	12	30	457	10	40	375
7	6	40	835	4	50	442	4	10	337	13	..	1259	8	35	654	8	..	555	17	45	1365	12	30	760	11	15	627	21	15	1182	15	20	685	12	45	533
8½	7	50	986	5	5	539	4	50	465	14	..	1300	10	15	881	9	15	743	20	15	1709	15	5	972	13	20	874	25	25	1401	18	5	912	15	30	710
10	8	30	1048	7	15	702	5	45	581	17	40	1573	12	..	1004	10	20	920	23	..	1998	16	25	1280	15	30	1052	26	45	1527	20	10	1115	18	55	1001

ARTILLERY DEPOT,
ST. THOMAS' MOUNT,
March 1855.

Note.—1 Madras pattern conical chambered Mortar—Weight Cwt. 1-2-25.
2 Experimental Bengal pattern gomer chambered Mortar, 2 inches longer than the Madras conical—Weight Cwt. 1-2-7-8.
3 Bengal pattern gomer chambered Mortar, 2 inches shorter than Madras conical—Weight Cwt. 1-1-10.

FEBRUARY 1856.

REMARKS.

In submitting the result of the experimental practice to test the comparative merits of the new 5½ inch Mortar of increased length and weight, cast at the Gun Carriage Manufactory, Madras, with the old pattern 5½ inch Conical Chamber Mortar, cast in Bengal, I may notice the following points which are not without interest.

The new Mortar is 18·1 inches long,	and	diameter of bore	5·66	inches.
The old Mortar is 13 „	and	„	5·63	„

The superficial measurement of the chamber of the new Mortar is 47·642*a*, with a capacity of 29·490 ; and the superficial measurement of the chamber of the other 35·8221*b*, with a capacity 19·1363.

Now it is unquestionable that the increased length of the new Mortar by giving a longer cylinder for the action of the elastic gas upon the shells, that is a longer duration of that action, would, all other conditions being the same, have given a longer range also. It has not done so ;—and the " reason why" is equally unquestionable. In constructing this new piece, the following deviations from the old pattern have neutralized the advantage of the increased length of bore. First the *increased windage* of 5·66 instead of 5·62 or 5·63, so increasing the measure of the windage ring by ·03, and secondly, by increasing the interior capacity of the chamber of the new Mortar, and so, decreasing the density of the gas evolved on the inflammation of similar charges. and also by exposing the gas to a larger cooling surface of chamber, and abstracting from it some degree of heat, the expansive force of the fluid which is due to its high temperature is further lessened.—In other words, the ill effects of larger windage, and larger chamber, have neutralized the good results which must otherwise have followed the increased length of cylinder recommended by the Artillery Select Committee in Meeting 182, Article 672—16th September 1853.

The strikingly equable character of the ranges with both pieces is deserving of attentien—the more so, as there is reason to apprehend that this piece of Ordnance is undervalued by some of our brother Artillerists. A piece which four men can move with its bed from position to position, and which has an effective range with a 24 Pdr. shell of nearly one mile, would in any country, and in any service have claims on consideration, but in this country its value, when properly constructed and handled, is higher still.

The initial velocities due to the 8½ oz. charges were so considerable that I was induced to test the two pieces further by a Ricochet Practice at those elevations which would be effective against Infantry, against Cavalry, and to ricochet Field works. The result is extremely satisfactory, as will appear from the Record.

The distances preflxed by an† shew the former ranges (in 1853) obtained by this same (a) Mortar, with similar charges and elevations, and establish its character for equability of range.

(Signed) G. W. Y. SIMPSON, Major,
Director Artillery Depot.

ARTILLERY DEPOT,
20th March 1856.

MEMORANDUM OF THE SUPERFICIES AND CONTENTS OF THE CHAMBERS OF THE UDERMENTIONED MORTARS.

5½ Inch Madras Conical.

G. Hutchinson, Fort William 1833, No. 75.

Superficies of chamber..................................35·8221.
Content of „ ....19·1363.

5½ Inch Bengal Gomer (long.)

Cossipore 1853, No. 1.

Superficies of chamber.................................. 79·526.
Content of „ .... 77·743.

5½ Inch Madras Conical (Experimental.)

J. M. 1855, Gun Carriage Manufactory.

Superficies of chamber.................................. 47·642.
Content of „ .... 29·490.

FEBRUARY 1856.

Table shewing the comparative Ranges obtained with similar elevations and charges, from the 5½ inch Brass Mortar (Experimental) cast at the Gun Carriage Manufactory, and a 5½ inch Brass Mortar, Conical Chamber, in use with the Madras Artillery.

Nature and strength of powder used.—Madras M. P. April 1854. *Origiual proof* 1 *lb.* 800 *yards.—Reproof in January* 1856—723 *yards.*

Date.	Elevation.	Charge.		Brass Mortar 5½ Inch Experimental.											5½ Inch Mortar Conical Chamber.											
				Shell.									Range.		Shell.									Range.		
					Weight.			Diameter.		Windage.	Flight.		Real.	Medium.		Weight.			Diameter.		Windage.	Flight.		Real.	Medium.	
		ozs.	drs.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.	
7th February 1856.	45°	2	0	1	16	5	4	5	58	·08	6	15	*210		1	16	4	12	5	58	·05	6	30	232		The figures prefixed by an† in the colmnn "of Medium Rauge" denote the Ranges obtained from the same Mortar with similar charges in April 1853.
		0	0	2	16	5	0	5	58	·08	6	30	226		2	16	3	8	5	58	·05	6	30	*245		
		0	0	3	16	6	12	5	58	·08	6	15	*206	231	3	16	4	0	5	58	·05	6	30	*220	229	
		0	0	4	16	4	12	5	59	·07	6	30	244		4	16	3	12	5	58	·05	6	30	225		
		0	0	5	16	3	8	5	59	·07	6	30	224		5	16	7	0	5	58	·05	6	30	229		
		2	4	6	16	3	12	5	58	·08	7	45	*287		6	16	4	0	5	58	·05	7	30	*276		
		0	0	7	16	3	4	5	58	·08	7	30	*274		7	16	5	0	5	58	·05	7	30	*286		
		0	0	8	16	6	0	5	58	·08	7	15	257	262	8	16	5	8	5	58	·05	7	15	265	263	
		0	0	9	16	4	12	5	58	·08	7	30	261		9	16	6	0	5	58	·05	7	15	264	†243	
		0	0	10	16	4	4	5	58	·08	7	30	268		10	16	6	0	5	58	·05	7	15	260		
		2	8	11	16	7	8	5	58	·08	8	0	299		11	16	3	8	5	58	·05	8	0	338		
		0	0	12	16	2	12	5	59	·07	8	15	*312		12	16	4	8	5	58	·05	8	15	356		
		0	0	13	16	5	0	5	59	·07	8	15	*322	297	13	16	5	0	5	58	·05	8	0	*316	349	
		0	0	14	16	4	8	5	58	·03	8	0	292		14	16	3	12	5	58	·05	8	15	357		
		0	0	15	16	4	4	5	58	·08	8	0	300		15	16	5	12	5	58	·05	8	0	*304		

7th February 1856.	45°	2	12	16	16	5	4	5	58	·08	8	30	331	333	16	16	7	0	5	58	·05	8	30	366	361
		0	0	17	16	4	12	5	58	·08	8	30	330		17	16	6	0	5	58	·05	8	30	352	
		0	0	18	16	5	8	5	58	·08	8	30	*344		18	16	4	4	5	58	·05	8	45	*386	
		0	0	19	16	5	4	5	58	·08	8	30	337		19	16	4	0	5	58	·05	8	30	364	
		0	0	20	16	4	8	5	58	·08	8	30	*362		20	16	5	4	5	58	·05	8	45	*380	
		3	0	21	16	4	0	5	58	·08	9	0	427	442	21	16	3	14	5	58	·05	9	0	*426	453
		0	0	22	16	5	12	5	58	·08	9	0	*401		22	16	3	8	5	58	·05	9	0	*417	
		0	0	23	16	6	4	5	58	·08	9	15	448		23	16	3	8	5	58	·05	9	15	462	
		0	0	24	16	5	4	5	58	·08	9	15	449		24	16	4	0	5	58	·05	9	0	434	
		0	0	25	16	3	0	5	58	·08	9	0	*402		25	16	4	0	5	58	·05	9	15	453	
		3	4	26	16	5	4	5	58	·08	9	30	477	483	26	16	4	8	5	58	·05	9	45	473	492
		0	0	27	16	3	8	5	58	·08	9	30	486		27	16	6	8	5	58	·05	10	0	491	
		0	0	28	16	5	8	5	58	·08	10	0	*509		28	16	3	8	5	58	·05	10	45	*626	
		0	0	29	16	4	8	5	58	·08	9	30	485		29	16	4	8	5	58	·05	10	0	512	
		0	0	30	16	5	0	5	58	·08	9	15	*456		30	16	5	8	5	58	·05	10	45	*644	
8th February 1856.		3	8	1	16	5	4	5	58	·08	9	45	*494	525	1	16	4	12	5	58	·05	11	15	*618	595
		0	0	2	16	5	0	5	58	·08	10	0	522		2	16	3	8	5	58	·05	11	0	595	
		0	0	3	16	6	12	5	58	·08	10	0	521		3	16	4	0	5	58	·05	10	30	*562	
		0	0	4	16	4	12	5	59	·07	10	15	533		4	16	3	12	5	58	·05	11	0	596	
		0	0	5	16	3	8	5	59	·07	10	15	*538		5	16	7	0	5	58	·05	11	0	594	
		3	12	6	16	3	12	5	58	·08	10	45	*592	605	6	16	4	0	5	58	·05	11	45	*650	731 †756
		0	0	7	16	3	4	5	58	·08	11	0	604		7	16	5	0	5	58	·05	11	30	754	
		0	0	8	16	6	0	5	58	·08	11	15	*642		8	16	5	8	5	58	·05	11	15	704	
		0	0	9	16	4	12	5	58	·08	11	0	600		9	16	6	0	5	58	·05	11	45	*640	
		0	0	10	16	4	4	5	58	·08	11	0	610		10	16	6	0	5	58	·05	11	30	735	
		4	0	11	16	7	8	5	58	·08	11	45	650	655	11	16	3	8	5	58	·05	12	45	774	780 †789
		0	0	12	16	2	12	5	59	·07	12	0	660		12	16	4	8	5	58	·05	12	45	776	
		0	0	13	16	5	0	5	59	·07	12	15	*683		13	16	5	0	5	58	·05	12	30	*834	
		0	0	14	16	4	8	5	58	·08	11	45	*639		14	16	3	12	5	58	·05	13	0	790	
		0	0	15	16	4	4	5	58	·08	11	45	654		15	16	5	12	5	58	·05	13	15	*816	

The figures prefixed by an † in the column "of Medium Range" denote the Ranges obtained from the same Mortar with similar charges in April 1853.

* These ranges are not included in calculating the mean range; the three rounds approximating closest to each other have been taken to fix the average.

FEBRUARY 1856—(*continued.*).

Date.	Elevation.	Charge.		Brass Mortar 5½ Inch Experimental.											5½ Inch Mortar Conical Chamber										
				Shell.									Range.		Shell.									Range.	
					Weight.			Diameter.		Windage.	Flight.		Real.	Medium.		Weight.			Diameter.		Windage.	Flight.		Real.	Medium.
		ozs.	drs.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.
8th February 1856.	45°	4	4	16	16	5	4	5	58	·08	12	45	750		16	16	7	0	5	58	·05	14	0	867	
		0	0	17	16	4	12	5	58	·08	12	30	*704		17	16	6	0	5	58	·05	14	0	*852	
		0	0	18	16	5	8	5	58	·08	13	0	786	779	18	16	4	4	5	58	·05	14	30	*893	873
		0	0	19	16	5	4	5	58	·08	12	45	*722		19	16	4	0	5	58	·05	14	15	873	†872
		0	0	20	16	4	8	5	58	·08	13	0	800		20	16	5	4	5	58	·05	14	15	879	
		4	8	21	16	4	0	5	58	·08	13	30	811		21	16	3	14	5	58	·05	14	30	896	
		0	0	22	16	5	12	5	58	·08	13	45	830		22	16	3	8	5	58	·05	14	15	*878	
		0	0	23	16	6	4	5	58	·08	13	45	*852	822	23	16	3	8	5	58	·05	14	30	885	891
		0	0	24	16	5	4	5	58	·08	14	0	*870		24	16	4	0	5	58	·05	14	30	892	
		0	0	25	16	3	0	5	58	·08	13	45	825		25	16	4	0	5	58	·05	15	0	*924	
12th February 1856.		5	0	1	16	5	4	5	58	·08	15	0	996		1	16	4	12	5	58	·05	15	45	*1064	
		0	0	2	16	5	0	5	58	·08	15	30	*1045		2	16	3	8	5	58	·05	15	0	940	
		0	0	3	16	6	12	5	58	·08	15	30	*1054	992	3	16	4	0	5	58	·05	15	0	960	953
		0	0	4	16	4	12	5	59	·07	15	0	992		4	16	3	12	5	58	·05	15	15	*990	†1015
		0	0	5	16	3	8	5	59	·07	15	0	988		5	16	7	0	5	58	·05	15	0	960	
		5	8	6	16	3	12	5	58	·08	16	15	1154		6	16	4	0	5	58	·05	16	0	*1120	
		0	0	7	16	3	4	5	58	·08	16	0	*1100		7	16	5	0	5	58	·05	16	15	1156	
		0	0	8	16	6	0	5	58	·08	16	15	1154	1152	8	16	5	8	5	58	·05	16	15	1158	1161
		0	0	9	16	4	12	5	58	·08	16	0	*1136		9	16	6	0	5	58	·05	16	0	*1132	†1055
		0	0	10	16	4	4	5	58	·08	16	15	1147		10	16	6	0	5	58	·05	16	15	1168	

The figures prefixed by an † in the column " of Medium Range" denote the Ranges obtained from the same Mortar with similar charges in April 1853.

12th February 1856.	45°	6	0	11	16	7	8	5	58	·08	17	0	1200	1209	11	16	3	8	5	58	·05	17	15	1278	1264 †1247
		0	0	12	16	2	12	5	59	·07	17	0	1222		12	16	4	8	5	58	·05	17	15	1250	
		0	0	13	16	5	0	5	59	·07	17	15	*1264		13	16	5	0	5	58	·05	17	15	1263	
		0	0	14	16	4	8	5	58	·08	17	0	1206		14	16	3	12	5	58	·05	17	30	*1322	
		0	0	15	16	4	4	5	58	·08	17	15	*1245		15	16	5	12	5	58	·05	17	0	*1197	
		6	8	16	16	5	4	5	58	·08	18	0	*1275	1339	16	16	7	0	5	58	·05	17	30	*1326	1349 †1341
		0	0	17	16	4	12	5	58	·08	18	0	1306		17	16	6	0	5	58	·05	17	30	*1356	
		0	0	18	16	5	8	5	58	·08	18	0	*1302		18	16	4	4	5	58	·05	17	30	1346	
		0	0	19	16	5	4	5	58	·08	18	15	1354		19	16	4	0	5	58	·05	17	30	1348	
		0	0	20	16	4	8	5	58	·08	18	15	1356		20	16	5	4	5	58	·05	17	30	1352	
		7	0	21	16	4	0	5	58	·08	18	15	1384	1366	21	16	3	14	5	58	·05	18	45	*1465	1429 †1422
		0	0	22	16	5	12	5	58	·08	18	15	1363		22	16	3	8	5	58	·05	18	30	1440	
		0	0	23	16	6	4	5	58	·08	18	30	*1416		23	16	3	8	5	58	·05	18	15	1422	
		0	0	24	16	5	4	5	58	·08	18	30	*1453		24	16	4	0	5	58	·05	18	15	1426	
		0	0	25	16	3	0	5	58	·03	18	15	1352		25	16	4	0	5	58	·05	18	0	*1364	
13th February 1856.		7	8	1	16	5	4	5	58	·08	19	0	1500	1513	1	16	4	12	5	58	·05	19	0	*1586	1543
		0	0	2	16	5	0	5	58	·08	18	30	*1438		2	16	3	8	5	58	·05	18	30	1532	
		0	0	3	16	6	12	5	58	·08	19	0	1519		3	16	4	0	5	58	·05	18	30	1550	
		0	0	4	16	4	12	5	59	·07	19	30	*1558		4	16	3	12	5	58	·05	18	30	1546	
		0	0	5	16	3	8	5	59	·07	19	0	1521		5	16	7	0	5	58	·05	19	15	*1520	
		8	0	6	16	3	12	5	58	·08	20	0	1575	1543	6	16	4	0	5	58	·05	18	15	*1530	1564
		0	0	7	16	3	4	5	58	·08	20	0	1584		7	16	5	0	5	58	·05	18	45	1564	
		0	0	8	16	6	0	5	58	·08	20	0	1570		8	16	5	8	5	58	·05	19	0	1570	
		0	0	9	16	4	12	5	58	·08	20	0	*1550		9	16	6	0	5	58	·05	18	45	1558	
		0	0	10	16	4	4	5	58	·08	20	45	*1643		10	16	6	0	5	58	·05	18	30	*1542	
		8	8	11	16	7	8	5	58	·08	20	45	1664	1670	11	16	3	8	5	58	·05	21	0	*1674	1633
		0	0	12	16	2	12	5	59	·07	20	30	*1603		12	16	4	8	5	58	·05	20	45	1648	
		0	0	13	16	5	0	5	59	·07	21	0	1670		13	16	5	0	5	58	·05	20	30	1614	
		0	0	14	16	4	8	5	58	·08	20	30	*1600		14	16	3	12	5	58	·05	22	0	*1685	
		0	0	15	16	4	4	5	58	·08	21	0	1676		15	16	5	12	5	58	·05	20	45	1638	

The figures prefixed by an † in the column "of Medium Range" denote the Ranges obtained from the same Mortar with similar charges in April 1853.

* These ranges are not included in calculating the mean range; the three rounds approximating closest to each other have been taken to fix the average.

RICOCHET PRACTICE February 1856, *St. Thomas' Mount.*

Date.	Charge.	Elevation.	Brass Mortar 5½ Inch Experimental.											Extreme Range.	5½ Inch Mortar Conical Chamber											Extreme Range.
			Shell.									Range.			Shell.									Range.		
				Weight.			Diameter.		Windage.	Flight.		First Graze.	Medium.			Weight.			Diameter.		Windage.	Flight.		First Graze.	Medium.	
	ozs.	deg.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.	yds.	No.	lbs.	ozs.	drs.	ins.	pts.	pts.	Sec.	Pts.	yards.	yards.	yds.
18th February 1856.	6	5	1	16	5	4	5	58	·08	3	0	*310		1108	1	16	4	12	5	58	·05	2	30	*262		902
	0	0	2	16	5	0	5	58	·08	2	45	281		..	2	16	3	8	5	58	·05	3	0	314		..
	0	0	3	16	6	12	5	58	·08	3	0	*316	282	1150	3	16	4	0	5	58	·05	3	0	308	318	1083
	0	0	4	16	4	12	5	59	·07	2	45	292		900	4	16	3	12	5	58	·05	3	15	331		..
	0	0	5	16	3	8	5	59	·07	2	30	273		524	5	16	7	0	5	58	·05	3	0	*309		915
	6	10	6	16	3	12	5	58	·08	4	30	538		..	6	16	4	0	5	58	·05	4	45	540		886
	0	0	7	16	3	4	5	58	·08	4	45	*550		..	7	16	5	0	5	58	·05	4	30	515		..
	0	0	8	16	6	0	5	58	·08	5	0	*462	531	920	8	16	5	8	5	58	·05	4	30	520	525	920
	0	0	9	16	4	12	5	58	·08	4	30	534		1000	9	16	6	0	5	58	·05	4	45	*546		1145
	0	0	10	16	4	4	5	58	·08	4	30	520		..	10	16	6	0	5	58	·05	5	0	*608		..
	7	10	11	16	7	8	5	58	·08	6	0	*690		..	11	16	3	8	5	58	·05	5	30	635		1341
	0	0	12	16	2	12	5	59	·07	5	0	582		1050	12	16	4	8	5	58	·05	5	45	*666		..
	0	0	13	16	5	0	5	59	·07	5	0	593	585	925	13	16	5	0	5	58	·05	6	0	*698	620	1249
	0	0	14	16	4	8	5	58	·08	5	45	*660		1216	14	16	3	12	5	58	·05	5	30	614		1150
	0	0	15	16	4	4	5	58	·08	5	0	581		1094	15	16	5	12	5	58	·05	5	30	611		942
	6	15	16	16	5	4	5	58	·08	5	30	*624		953	16	16	7	0	5	58	·05	6	45	749		880
	0	0	17	16	4	12	5	58	·08	6	0	*692		836	17	16	6	0	5	58	·05	6	0	*692		970
	0	0	18	16	5	8	5	58	·08	5	45	674	634	940	18	16	4	4	5	58	·05	6	45	740	743	1206
	0	0	19	16	5	4	5	58	·08	6	0	651		860	19	16	4	0	5	58	·05	7	0	*788		1340
	0	0	20	16	4	8	5	58	·08	5	0	578		887	20	16	5	4	5	58	·05	6	45	739		950
	7	15	21	16	4	0	5	58	·08	7	0	822		..	21	16	3	14	5	58	·05	7	30	856		1320
	0	0	22	16	5	12	5	58	·08	7	30	872		1346	22	16	3	8	5	58	·05	7	30	842		1140
	0	0	23	16	6	4	5	58	·08	7	0	798	831	947	23	16	3	8	5	58	·05	7	0	*832	855	1254
	0	0	24	16	5	4	5	58	·08	6	45	*753		1070	24	16	4	0	5	58	·05	7	30	868		1243
	0	0	25	16	3	0	5	58	·08	6	0	*674		1300	25	16	4	0	5	58	·05	7	45	*888		879

ARTILLERY DEPOT,
ST. THOMAS' MOUNT,
20th March 1856.

(Signed) G. W. Y. SIMPSON, Major, *Director Artillery Depot.*

(Signed) F. BLUNDELL, Major General, *Commandant of Artillery.*

Experimental Practice, carried on at Trichinopoly under Major G. Rowlandson, Commanding Artillery Southern Division.

The proximity of hills, between two and three miles distance, affording favorable opportunity for practice with morters, throwing shells from the plain on to hills and vice versa, and also from the summit of the highest hill on to another at some distance, with the concurrence of the Authorities, Civil and Military, advantage was accordingly taken of it and the results are shown in the annexed Report. On the first day, all Officers and Non Commissioned Officers of Horse and Foot Artillery, the latter being carried on their waggons, and a party from the Troop mounted, starting early, dismounted the mortars 1-8 inch and 2-4 $\frac{2}{5}$ inch in battery under a bank. The distance meanwhile being ascertained by a Pocket Sextant and four rounds fired, until the Practice proved satisfactory ;—each Officer in charge, giving charges and elevation to his own piece.

On the second morning, the same was repeated. only at a more distant position and with two more $4\frac{2}{5}$ inch mortars.

On the third morning only the small mortars were taken out, and on arriving at the foot of the highest hill (ascertained by the Sextant to be about 150 feet perpendicular height) they were slung on bamboos, and rapidly carried by the men to the summit, the ascent being very rugged and steep and thence played on a hill, computed, by Sextant to be about six hundred yards distant, the mortars being fired both with high and low elevations. Two rounds were also fired at a flag pitched on the plain at random, and fire opened at a distance estimated by the eye only. The Practice was over each morning about 8 o'clock, and great interest was taken by all Ranks in it, from the novelty and practical utility of the instruction derived from it: and it would doubtless conduce very much to the value and interest of our Annual Practice if advantage were taken of the peculiarities of the various stations, and their neighbourhood to afford practical instruction in the less regular, but in this country much oftener needed application of our arms, than the formal and systematic operations adhered to in our Annual plan of Practice.

(Signed) G. Rowlandson, Captain, (Major)
Commanding Arty. Sn. Division.

Trichinopoly,
March 31*st*, 1856.

Report of Experimental Practice carried on at Trichinopoly under the Orders of Major G. Rowlandson, Commanding Artillery Southern Division.

Date.	Ordnance.	No. of firings.	Shells No.	Weight of Powder.			Elevation.		Fuze.	Flight.		Fuze started.		Distance of object.	Remarks.
				lbs.	ozs.	drs.	D.	M.	inches.	Sec.	Pts.	Sec.	Pts.	yards.	
March 14th, 1856.	8 inch Mortar.	1	1	0	13	0	47	30	1·9½	10	0	9	45	A hill distance from foot of which was 485 yards.	Shell fell at foot of hill.
		2	2	0	14	0	47	30	2·1	10	0	10	0		„ „ ⅓ way up.
		3	3	0	14	12	47	30	2·2	10	0	0	0		„ „ ⅔ „ „
		4	4	0	14	14	47	30	2	11	0	12	0		„ „ on top of „
	4⅖ in. No. 1.	1	1	0	2	8	47	30	1·9½	9	30	9	0		Rather over the hill.
		2	2	0	2	10	47	30	2·1	0	0	0	0		Struck rock ½ way down further side.
		3	3	0	2	7	47	30	2·1	11	0	0	0		Slightly over top.
		4	4	0	2	5	47	30	2	11	0	11	30		Fell on top.
	4⅖ in. No. 2.	1	1	0	2	8	47	30	1·9½	11	30	0	0		Over the hill fuze not seen.
		2	2	0	2	10	47	30	2·1	12	0	0	0		„ „ „ „ „ „
		3	3	0	2	7	47	30	2·1	12	0	10	0		½ way down further side.
		4	4	0	2	5	47	30	2	11	30	10	0		Fell on top.
March 15th 1856.	8 inch Mortar.	1	1	1	1	2	46	45	2·4½	12	0	0	0	792 yards to foot of a hill.	Shell fell 25 yds. short of hill fuze, not seen.
		2	2	1	2	0	46	45	2·5½	12	30	0	0		„ „ ½ way up hill and broke on rock.
		3	3	1	2	8	46	45	2·6	13	0	0	0		„ „ ⅓ „ „ „ „ „ „ „
		4	4	1	2	10	46	45	2·6½	12	30	13	30		„ „ ⅔ „ „ „ „ „ „ „
	4⅖ in. No. 1.	1	1	0	2	14	46	45	2·5	14	0	13	0		Fell at bottom of hill.
		2	2	0	3	0	46	45	2·6	13	0	13	0		„ ½ way up.
		3	3	0	3	4	46	45	2·6½	14	0	13	0		„ nearly on top of hill.
		4	4	0	3	4	46	45	2·6	0	0	0	0		Rather over.
	4⅖ in. No. 2.	1	1	0	2	14	46	45	2·5	12	0	13	0		Fell at bottom of hill.
		2	2	0	3	0	46	45	2·6	13	0	14	0		„ ½ way up.
		3	3	0	3	4	46	45	2·6⅓	13	0	0	0		„ ⅔ „ „
		4	4	0	3	4	46	45	2·6	0	0	0	0		Not seen.

March 15th 1856.	4⅖ in. No. 3.	1	1	0	2	14	46	45	2·5	12	30	12	0	792 yards to foot of a hill.	Fell a short distance from bottom.
		2	2	0	3	0	46	45	2·6	13	0	0	0		„ ⅔ way up.
		3	3	0	3	4	46	45	2·6½	14	0	13	0		„ near top.
		4	4	0	3	4	46	45	2·6	13	0	13	0		„ rather over.
	4⅖ in. No. 4.	1	1	0	2	14	46	45	2·5	13	0	13	0		Fell at bottom of hill.
		2	2	0	3	0	46	45	2·6	12	0	14	0		„ ⅔ way up.
		3	3	0	3	4	46	45	2·6½	12	0	16	0		„ rather over.
		4	4	0	3	4	46	45	2·6	13	0	13	0		„ on top.
March 17th 1856.	4⅖ inch No. 1.	1	1	0	2	10	43	13	2·2½	12	0	12	0	A flag on a hill distance 650 yds.	Shell fell 30 yards short of hill.
		2	2	0	2	13	43	13	2·2½	12	0	12	0		„ „ ½ way up „ „
		3	3	0	3	0	43	13	2·2½	0	0	0	0		„ „ rather over fuze not seen.
		4	4	0	3	12	40		1·5	0	0	0	0		As howitzer fuze not seen, over hill.
		5	5	0	1	15	29	30	1·7	7	30	8	0	A flag on a plain estimated distance 500 yards.	50 yards short.
		6	6	0	2	3	39	30	2·	10	0	11	0		5 „ „
	4⅖ inch No. 2.	1	1	0	2	10	33	13	2·2½	13	0	13	0	A flag on a hill distance 650 yds.	¾ way up hill.
		2	2	0	2	10	43	13	2·2½	12	0	12	30		„ „ „ „
		3	3	0	2	10	43	13	2·2½	13	0	13	0		Very near the top.
		4	4	0	3	12	20		1·5	0	0	9	0		As howitzer, fuze burst in air, shell over.
		5	5	0	1	15	39	30	1·7	8	0	9	0	A flag on a plain estimated distance 500 yards.	100 yards short.
		6	6	0	2	3	39	30	2·	10	0	0	0		30 „ „
	4⅖ inch No. 3.	1	1	0	2	10	43	13	2·2½	12	30	12	30	A flag on a hill distance 650 yards.	Fell at foot of hill.
		2	2	0	2	11	43	13	2·2½	13	0	14	0		Over.
		3	3	0	2	10	48	13	2·2½	13	30	12	0		Near the top.
		4	4	0	3	12	20		1·5	0	0	8	30		All three slightly over, as howitzers.
		5	5	0	3	8	20		1·7	0	0	8	0		
		6	6	0	3	6	20		1·7	7	0	8	0		
	4⅖ inch No. 4.	1	1	0	2	10	43	13	2·2½	12	0	12	0		Fell short of hill.
		2	2	0	2	11	43	13	2·2½	12	30	13	0		„ at foot.
		3	3	0	2	10	43	13	2·2½	12	30	12	30		„ „ „
		4	4	0	3	12	20		1·5	0	0	7	30		As howitzers, all three were more or less over* fuze not seen.
		5	5	0	3	8	20		1·7	*0	0	*0	0		
		6	6	0	3	6	20		1·7	8	0	8	0		

(Signed) G. ROWLANDSON, Captain, (Major)
Commanding Artillery Southern Division.

GENERAL OBSERVATIONS.

On the Practice carried on at Trichinopoly in the year 1856.

In conformity with para 10, of Memorandum appended to plan of Practice inviting Officers to offer suggestions on matters relating to Practice, I beg respectfully to submit for the consideration of the Commandant of Artillery, the expediency of a greater variety in the Practice for the breaching guns; the sameness and monotony of firing so many days at a fixed distance, being felt very irksome by all ranks. If the distance commenced at 800 yards, and were gradually reduced, after three days firing 200 yards each time until they came to 200 yards from the butt; with a different kind of battery at each distance, viz. 1st en-barbette, 2d half sunken, 3d sunken, and 4th raised (by which time the mortars would be firing at their longest ranges) it would greatly enhance the interest and value of the practice. The direction of the Ricochet battery might be easily arranged so as not to interfere with this object; and at this Station, the traverses, have been raised in a direction diverging from the butt, and so, obviating all interference with the breaching gun practice. The mortar range is equally susceptible of change in direction. The practice of the 4⅖ inch mortars, in the absence of any instructions, has been designed to furnish data for tables at all charges and elevations somewhat similar to those for the 5½ inch at page 5 of last edition of Gunner's Assistant,—a desideration much felt, in the use of these useful little pieces.

(Signed) G. Rowlandson, Captain, (Major)
Commanding Arty. Sn. Division.

Trichinopoly,
March 31*st*, 1856.

Abstract of Practice, with $4\frac{2}{5}$ inch brass Conical Chambered Mortars, carried on at Trichinopoly at the Annual Artillery Practice in the year 1856, *with various charges and elevations.*

Charge.		10°		20°		30°		40°		45°		50°		55°		60°		65°		70°		75°		80°	
		Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.	Flight.	Range.
ozs.	drs.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.	Sec.	yds.
2	0	2¼	159	4	260	6¾	452	8¾	474	9¾	501	..	..	11	476	..	..	12¾	415	..	..	13	254	13½	178
3	0	4	391	6½	570	9½	810	12	856	12½	802	13¾	793	14½	811	15¼	674	16¼	648	17	543	..	..	..	..
4	0	5	540	7½	793	11¼	1074	13¾	1146	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

(Signed) G. ROWLANDSON, Captain, (Major)
Comg. Arty. Southern Division.

Abstract Report on Spherical Case Shot Fuzes, received from the Arsenal at Seetabuldee and submitted to Proof at Kamptee, agreeably to instructions received from the Military Board.

N. B.—The length of each Fuze was carefully taken, first by counting the divisions marked on it, and afterwards by measurement with a pair of compasses.

The time was taken by a standard Pendulum received from the Arsenal for that purpose.

Number proved.	Length to which the Fuzes were cut.		Regulated time of burning.	Time of burning.									Remarks.
	ins.	ths.	Sec.	Seconds.	Driven from 1816 to 1819.	” in 1825.	” 1826.	” 1827.	” 1828.	” 1829.	” 1830.	” 1832.	
20 of each years driving.	1	4	7	9½	1	0	0	0	0	0	0	0	
				9¼	2	0	0	0	0	0	0	0	
				9	4	0	1	0	0	0	0	0	
				8¾	2	0	0	0	0	0	0	0	
				8½	2	0	0	1	0	0	0	1	
				8¼	1	0	1	0	0	0	1	1	
				8	3	4	9	8	0	1	3	6	
				7¾	1	5	3	3	1	2	9	5	
				7½	0	4	1	2	7	6	0	4	
				7¼	1	2	0	0	1	9	3	2	
				7	2	3	4	6	11	2	3	1	
				6¾	0	2	1	0	0	0	0	0	
				6½	0	0	0	0	0	0	1	0	
				0	(a) 1	0	0	0	0	0	0	0	(a) Failed.
20 of each years driving.	1	2	6	9	0	1	0	0	0	0	0	0	
				8½	1	0	0	0	0	0	0	1	
				8¼	1	0	0	0	0	0	0	0	
				8	1	0	0	0	0	0	0	1	
				7½	1	0	0	2	0	0	0	3	
				7¼	0	0	0	0	0	0	0	3	
				7	4	1	4	5	0	0	6	5	
				6¾	0	1	4	4	2	5	1	1	
				6½	0	2	2	6	7	3	3	2	(b) 12 Fuzes (7 of which the year when driven not known) cut to 1 inch 1½ tenths, the whole failed at the first second, except one which burnt 6 seconds.
				6¼	0	3	1	2	4	6	5	4	
				6	0	8	9	1	6	6	3	0	
				5¾	0	3	0	0	0	0	2	0	
				5	0	1	0	0	0	0	0	0	
				0	(b) 12	0	0	0	(c) 1	0	0	0	(c) Ignited at both ends.
20 of each years driving.	1	0	5	7	2	0	0	0	0	0	1	1	
				6½	2	0	0	0	0	0	0	1	
				6¼	2	0	0	0	0	0	0	0	
				6	9	0	1	1	0	0	2	7	
				5¾	0	1	6	4	0	2	4	3	
				5½	1	3	2	2	3	2	2	3	
				5¼	1	4	2	4	2	5	4	3	
				5	2	6	8	7	15	11	5	2	
				4¾	0	2	1	2	0	0	1	0	
				4½	0	1	0	0	0	0	1	0	
				4	0	3	0	0	0	0	0	0	
				0	(d) 1	0	0	0	0	0	0	0	(d) Cut to 9½ tenths and failed.

Number proved.	Length to which the Fuzes were cut.		Regulated time of burning.	Time of burning.									Remarks.
	ins.	ths.	Sec.	Seconds.	Driven from 1816 to 1819.	" in 1825.	" 1826.	" 1827.	" 1828.	" 1829.	" 1830.	" 1832.	
20 of each years driving.	0	8	4	6	2	0	0	0	0	0	0	1	
				5¾	0	0	0	0	0	0	0	1	
				5½	2	0	0	0	0	0	0	0	
				5	2	1	0	0	0	0	1	6	
				4¾	4	0	2	4	1	0	2	6	
				4½	4	1	1	6	1	1	6	1	
				4¼	1	0	2	2	10	8	2	3	
				4	5	10	12	8	8	11	8	2	
				3¾	0	2	1	0	0	0	0	0	
				3½	0	2	2	0	0	0	0	0	
				3¼	0	2	0	0	0	0	0	0	
				0	0	(e)2	0	0	0	0	(c)	0	(e) Ignited at both ends. (c) One not entered.
20 of each years driving.	0	6	3	5½	1	0	0	0	0	0	0	0	
				5	1	0	0	0	0	0	0	0	
				4½	0	0	0	1	0	0	0	0	
				4	6	0	1	0	0	0	0	1	
				3¾	6	2	2	0	0	0	0	9	
				3½	0	1	0	1	2	2	2	4	
				3¼	2	2	4	3	6	2	5	3	
				3	1	13	11	14	12	16	12	1	
				2¾	0	0	1	0	0	0	0	0	
				2½	0	1	0	1	0	0	1	0	
				2	1	0	1	0	0	0	0	0	
				1½	0	1	0	0	0	0	0	0	
				0	(f)2	0	0	0	0	0	0	(f)2	(f) Ignited at both ends.

GENERAL REMARKS.

The Fuzes of 1825 are considered serviceable.

do. 1826 do.

do. 1827 do.

but are badly graduated.

The Fuzes of 1828 are considered serviceable.

do. 1829 do.

do. 1830 do. The Fuzes of this year are badly graduated and many burnt longer than the regulated time.

The Fuzes of 1831 none submitted.

do. 1832 may be considered serviceable, but they are of different kinds of wood, the composition driven to different lengths, and the fuzes generally burnt longer than the regulated time.

The Fuzes received from the Arsenal which are not mentioned in the Board's letter.

Fuzes of different years varying from 1816 to 1819.

These fuzes are of a bad shape, the composition is not driven in the centre of many of them, and they generally burnt much too long beyond the regulated time. The whole of these fuzes are considered unserviceable.

Fuzes of former years having circles graduated but no other marks observable.

These fuzes are much blackened apparently from the length of time they have been in store; the composition is completely decayed; none of them burnt a second. The whole of the fuzes of this description are considered unserviceable.

The upper circle was not distinguishable on many of the fuzes submitted to proof.

(Signed) J. W. Croggan, Lieut. Col.,
Comg. Arty. Nagpore Force.

Kamptee, *April* 1856.

Abstract Report of Experiments at the Artillery Depot, with 5½ inch Spherical Case Shot Fuzes, received from the Commissary of Ordnance Nagpore Force. as per Extract from the Proceedings of the Military Board No. 6477, under date 12th March 1856.

Twenty Fuzes of each year were taken indiscriminately from the number received, result of burning noted below.

Number proved.	Length to which cut.	Regulated time of burning.	Time of burning.								Remarks.
			Seconds.	Driven in 1825.	Do. in 1826.	Do. in 1827.	Do. in 1828.	Do. in 1829.	Do. in 1830.	Do. in 1832.	
20 of each years driving.	1 inch.	5 seconds.	6	2	4	1	1	0	3	0	Two Fuzes of each year were split lengthways, the composition in the whole appeared to be firmly and uniformly driven. The Fuzes were made of beech and exhibited the superiority of that description of wood in preserving the composition; the oldest of the Fuzes under trial having been driven 31 years since.
			5½	3	9	7	0	3	5	2	
			5¼	3	3	2	1	6	3	3	
			5	11	4	10	17	11	9	15	
			4½	1	0	0	1	0	0	0	
			Total..	20	20	20	20	20	20	20	

Artillery Depot,
Saint Thomas' Mount.
13th *May* 1856.

(Signed) G. W. Y. Simpson. Major,
Dirctor Artillery Depot.
(Signed) Æ. Shirreff, Brigadier,
Commandant of Artillery.

Sinde Rifle Practice.

We have great pleasure in publishing the following account—from the very best authority—of some singularly interesting practice which took place at Kurrachee very recently with Colonel Jacob's Rifle Shells :—

Memorandum of Rifle Practice.

On the 23d August 1853,* an ammunition waggon was constructed out of an old country cart, with a box on it about the size of a pair of the ordinary ammunition boxes in use with a field battery.

The dimensions of the side of the box towards the riflemen were four feet long by two feet high, the front of the box (the side towards the shooters) was 1½ inches thick, the other sides and lid one inch thick, of common deal. The box was filled with damaged gunpowder in cotton bags, each containing 2 lbs., the whole charge being about 100 lbs. The box was properly secured, and was covered outside with tarpaulin nailed over it. The cart thus prepared was placed at the foot of the butt touching the wall, and was then fired at with Colonel Jacob's percussion rifle shells at twelve hundred yards distance (1200 yards) by four gentlemen mentioned below.

Mr. Gibbs, using a little double 32 gauge rifle by Witton and Daw.

Captain Gibbard, rifle, double 16 gauge, Manton.

Colonel Jacob, rifle, double, 24 gauge, Manton.

Captain Scott, rifle, double Army rifle 24 gauge.

The morning was very cloudy—it appeared about to rain. The butt itself looked dim and hazy,—the cart was not very distinctly visible, and it required a practised eye to see the box at all. The morning was so dark and the weather altogether so unfavorable that after a few rounds it was proposed to defer the experiment till another day. Nearly thirty shells in all had been fired without exploding the powder.

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* So published. Query 1856?

The shells were heard to burst with a loud report. Many appeared to strike the cart or very near to it, but it was too dark to see exactly where they struck; when the ninth shell from Mr. Gibb's rifle (32 gauge only) struck the box, and exploded the powder with the most brilliant effect.

The experiment was the more successful as the circumstances were as unfavorable as possible to the riflemen.

Among the gentlemen present at this experiment were,

Colonel Trevelyan, Artillery,
Captain Gibbard, „
„ Scott, A. D. C.
„ Dunsterville,
Mr. Cavanagh,
Mr. Maher,
Mr. Gibbs,
Colonel Jacob,
The Reverend Mr. Gell,
Captain Thatcher, and others.

Notwithstanding the perfect success of this experiment, and the repeatedly observed fact that the rifle shells were as effective at 1600 or even 1800 yards as at 1200, it was still supposed by some Officers that the manner in which the shot and cartridges are packed in the Artillery ammunition waggons would prevent the possibility of the rifle shells reaching the powder, even if they burst among the shot in the boxes.

To test this opinion, a waggon was now prepared with four boxes on it, similar in all respects to those of an ordinary ammunition waggon of a field battery; these boxes were packed with round shot, cartridges, &c. exactly like those of a regular field battery, and all being properly arranged, on the morning of the 25th August proceedings were resumed.

On this occasion as before the distance was 1200 yards. The riflemen were,

Mr. Gibbs, using a double 16 gauge rifle Witton & Daw.
Captain Gibbard, double 16 gauge, Manton.
Captain Thatcher, single 16 gauge, Manton.
Colonel Jacob, double 24 gauge, Manton.
An occasional shot or two were fired by other parties.

The morning was clearer than on the first day, and the practice was better. Nearly every shell appeared to strike some part of the waggon, and the seventh shell from Captain Gibbard's rifle exploded one of the four ammunition boxes; from the violence of the explosion, the volume of smoke, and the burning substance scattered about, it was thought that the whole waggon had exploded, but when at last the smoke cleared away it was observed through a telescope that some boxes remained whole, and firing was resumed; the fifth shell from Colonel Jacob's rifle entered another box and a second explosion took place. There was now so much smoke and fire about the waggon, and the whole front of the butt, that it was thought unnecessary to continue the practice, and the company proceeded to the butt to examine the effect. Two boxes were found unexploded, though one had its lid blown off, but the waggon itself was burning strongly, the fire blazing up round one of the boxes, while burning wood, portfires &c. &c. were thickly scattered all over the ground—for a distance of nearly 100 yards from the butt. It was evident that the neighbourhood was dangerous, and the spectators were warned off just in time, for hardly had they retired out of reach when the fire of the burning waggon reached the powder in one of the remaining boxes, and it exploded with stunning effect.

The remaining box, with the lid blown off, strange to say, still remained in the middle of the burning debris, but another rifle shell was soon put through it and exploded this also.

The waggon was of course totally destroyed, except the wheels, which were not much hurt, and it was quite evident that the destruction of one waggon in this manner must cause that of a whole battery. There were present on this occasion the gentlemen mentioned below.

General Scott, C. B.
Colonel Case,
,, Trevelyan,
Captain Scott,
Lieut. Mainwaring,
Captain Thatcher,
Serjeant Major Murry,
Captain Marston,
Mr. Maher,
Colonel Jacob,
Captain Gibbard,
Mr. Gibbs,
Lieut. Devitre, Artillery,
,, Devitre, 2d Eur.
Sheik Ghoolam Hussein Khan Saib Bahadoor,
Lieut. Finch, Engineers,
,, Soady, do.
,, Taylor, and others.

The result of these experiments is a corroboration of the statement that no field Artillery, as at present constituted, could live before a small body of marksmen plying it from a distance with these formidable missiles.—*Bombay Gazette, September 1st,* 1856.

Report of 2 Trials of Execution with Enfield Muskets at long ranges, against, a Column of Infantry, and Light Field Artillery, at the School of Musketry at Hythe—Extracted from Colburn's United Service Magazine, and Naval and Military Journal for August 1856.

1st. Trial against a Column of Infantry.

We will now recount the proceedings of a trial made at Hythe, to ascertain the amount of execution that may be expected at long ranges from a subdivision of thirty-five men against a battalion column of infantry, at quarter distance, the correct distance being unknown to the men. Out of the whole detachment ten had never fired with a rifle musket before joining the establishment, and the remainder, except three who had been previously trained at the school of musketry, had only fired from ten to thirty or forty rounds.

It has been ascertained by experiment that at the distance of 600 yards from the firing point the bullet of an Enfield rifle will fall six feet in passing over a space of sixty yards, whilst at 800 yards it will fall the same quantity in about forty yards. It is therefore obvious that much execution will be done against a battalion column by shots which, passing over the front rank of the column, fall upon the companies in rear.

As a battalion column of ten companies of thirty-five file per company will occupy from front to rear a space of about fifty yards, it follows that any bullet which at a distance of 600 yards is projected so as to pass within five feet above the front rank, will still do execution upon the column, and also that any over-estimate of the distance which does not exceed sixty, seventy, or eighty yards, will not necessarily cause the fire to miss a column of this depth, but that the shot will strike the column somewhere within the heads of the rearmost ranks ; on the other hand, all shots which strike the ground short of the front rank, but within a few yards of it, will hit the column by ricochet.

From this it is evident that although great accuracy in judging distance is necessary when firing at long ranges at a small object, such as the bull's-eye of a target, this is not the case when the object is a mass of infantry in column, whose depth affords a large margin on either side for the appreciation of distance. Hence it appears that although the circumstances of actual war must place the soldier under many disadvantages in respect to accurate firing, there are concomitant advantages attending the position and formation of the enemy's line of battle which must always render the fire of a line of skirmishers, armed with a rifle musket, most murderous, and even insurmountable, *provided they are trained to the use of their arms.*

In order to test practically the value of these considerations, the following trial was made against a double line of targets, placed one behind another at a distance of fifty yards, to represent the front and rear of a column of infantry of ten companies at quarter distance. Each target was sixty feet in length by six in height, or a front of about thirty-five file. The front target was of cast iron, so that no shots could hit the linen target in rear except such as had passed over the front target. The ground on which the target stood was perfectly level. In order to render the conditions of firing as nearly akin as possible to actual warfare, it was decided to conduct the practice as much as possible under the most disadvantageous circumstances :—

1st A day was selected for the practice when a heavy gale of wind was blowing right across the range; indeed, so strong was the wind that it was with the greatest difficulty the linen target could be made to stand, although the staves supporting it were buried three feet in the shingles.

2d The men were taken out for three hours's kirmishing practice before firing, so that they had already performed a hard day's work before the practice commenced.

3d Ten rounds of blank* ammunition had been fired out of each musket in the morning, and the arms were brought to the practice ground without cleaning, causing most of the bullets to stick hard in the barrel whilst loading.

4th The targets were placed upon the shingles†, on which it had been found by frequent trials that fewer shots strike the target by ricochet than when bounding from ordinary soil or grass.

5th The practice was conducted upon ground on which the men had never before been exercised, and with totally different aspect from that of the ordinary practice-ground, the back-ground of the targets being an expanse of open sea, which is most unfavourable for the firing.

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* Blank cartridge always fouls the barrel more than ball cartridge. With the ball cartridge, the bullet partially clears the barrel in passing out of it; whereas with the blank cartridge the whole of the residuum adheres to the side of the barrel.

† The practice-ground near Hythe is a vast expanse of shingles, from which the sea retired at a remote period. It is perfectly level, and in all respects well suited to musketry practice.

6th When firing on ordinary soil, the dirt thrown up when the bullet strikes the earth indicates to the firer the effect of his shot; but when firing on the shingles, the soldier cannot see where his shot strikes, and he has therefore no means of correcting his elevation as the firing proceeds. The wind, moreover, was blowing strongly, and none of the shots could be heard when they struck the targets.

The subdivision was divided into two sections, and was marched on the road to Dymchurch, from which the position of the targets could not be seen, except at intervals between the bushes; they were extended behind some rising ground, the right section in skirmishing order, the left in support; the whole then advanced until the skirmishing party reached a rising ground from which the targets first became visible; they then halted, and the men commenced judging their own distance by the eye. After having fired ten rounds per man at this distance, which was afterwards ascertained to be 820 yards, the section was advanced, expending another ten rounds in advancing 550 yards, when they again halted, and completed their thirty rounds per man. They were then relieved by the other section, which fired ten rounds at this distance, ten retiring by alternate ranks, and the remaining rounds at the distance of about 800 yards.

The total amount of ammunition fired by the thirty-five men was 1,050 rounds. It will be observed in this practice that the men were deprived of all clue to the distance, excepting so far as they might be able from previous practice to judge it by the eye, the whole trial being conducted as if in the actual presence of an enemy. At the longer range it was judged necessary to make allowance for the wind, by aiming quite to the right edge of the target.

On examining the targets, it was found that out of 1,050 shots fired 379 had hit the foremost target, and 238 the rear target, making in all 617 hits, or a proportion of fifty-eight per cent. Out of the 379 shots which hit the front target, 293 were fair hits, and may therefore be considered as the result of accuracy in judging distance ; the proportion of fair hits to ricochets in the linen target could not be ascertained.

Estimating the strength of the column at 700 men, and deducting one-tenth of the hits for shots which would pass between the files, or for men wounded by two bullets, it follows that out of the 700 men comprising the battalion, casualties would have occurred to the number of 550 men, who would either be killed or wounded, leaving a remainder of 150 men. When however, it is considered that a number of the shots would pierce two bodies it is not too much to suppose that the whole column would have been annihilated, and this by a subdivision not exceeding thirty-five men, each man expending thirty-rounds, or half the ammunition contained in his pouch.

2d. Trial against Light Field Artillery.

We shall now see the proceedings of a trial to ascertain the probable amount of execution that might be expected at long ranges from a party of men who had passed through one course of training, firing at field-artillery coming into action.

The firing party for this trial consisted of thirty file taken from the non-commissioned officers and privates of the 1st and 2d classes, who had just concluded a course of instruction ; twenty-three men of this party had never fired from a rifled musket before they came to the School of Musketry ; only twenty-three had fired in the 1st class, or at distances beyond 600 yards, of whom only seven had obtained the number of points (viz. 5) in shooting in said class, necessary, together with other qualifications, to entitle them to the distinction of marks-men, as lately recommended in a scheme for rewarding merit in shooting.

A group representing a field piece coming into action, the limber in the act of being driven to the rear, was arranged on the practice ground ; the figures of the men and horses were of the ordinary size ; the colour of the horses was dark, and did not present any clearly defined spot to aim at, except the drivers on the horses. The horses of the ammunition wagon, which was in position 50 yards directly in rear of the gun, and in continuation of the line of range, were represented by iron targets 6 feet by 2 feet, placed in pairs behind each other, at intervals of 6 feet ; thus showing a front of only 5 feet, including one foot between each pair of targets, which described the vertical sections of two horses ; the figures of horses, defining chest and legs, were painted on these sections, and no shot was counted that did not strike within those limits ; no men were represented, and therefore the ammunition wagon, with its horses, presented a much smaller object than in reality it would have done. The wind during the trial was strong across the range :

The party was arranged in skirmishing order at 610 yards' distance ; on the bugle sounding to commence firing, the whole party dropped on the knee and proceeded to fire in the order observed by skirmishers. The firing was stopped precisely at two minutes from the time the bugle sounded to commence firing, when it was found that each man had fired two rounds. On carefule xamination of the effect produced, it was found that at 610 yards seven men and six horses were disabled or hit. Had both ranks fired together, instead of the one rank waiting for the completion of the loading of the other, the same execution would have been done in half the time, or one minute.

The same order was observed in firing at 815 yards, except that the time occupied in firing was extended to three minutes, at the expiration of which it was found that the front rank had expended three rounds, the rear rank two, when six men and five horses were hit ; at both distances the shaft horses were disabled.

The above does not include the damage done to the horses of the ammunition wagon, of which at 610 yards four were hit, and at 815 yards five.

When the moderate amount of proficiency and short training of the men who fired in this experiment, and the novelty of the mark fired at, are considered, the trial will convey a tolerably accurate idea of what may be effected by large numbers of carefully selected marksmen, if called on to put down the fire of Artillery at 800 and 1000 yards. Each brigade would be able to turn out at least 300 qualified marksmen.

No account was taken of the numerous shots which struck the limber and gun-carriage ; some shots penetrated the ammunition boxes, and it becomes a question whether the use of a small shell fired from a rifle musket might not be effective in such exceptional cases.*

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* For successful experiments in exploding a loaded Ammunition Tumbril,—See Page 38.

Reports of Experiments carried on with 32 Pounder shot, cast at the Porto Novo Iron Works, and received through Messrs. Parry and Co.

Letter No 5478, *from the Military Board to the Brigadier Commandant of Artillery, dated* 24*th December* 1856.

Sir,—I have the honor to enclose a Report (to be returned) of the Principal Commissary of Ordnance No. 2738 of 5th December 1856, on some shot cast at Porto Novo, and the Board would be glad if these shot could be tested against English shot; and some pains taken to see whether any difference is observed.

2. If possible the Board wish the shot to be recovered, or as many as possible.

(Signed) A. H. Hope,
Secretary.

Letter No. 2738 *from Colonel P. Hamond, Principal Commissary of Ordnance to the Secretary Military Board, dated* 5*th December* 1856.

Sir,—In forwarding for submission to the Military Board the accompanying Proceedings of a Committee of Warrant Officers, that assembled in the Grand Arsenal to examine and report upon thirty-two 32 Pdr. shot cast at the Iron Works at Porto Novo, I beg to remark, that though the experiment has not been completely successful, yet the result is sufficiently satisfactory to justify further trials in casting shot at the Porto Novo establishment.

2. With reference to the concluding para of the Committee's Proceedings, I beg to state that although both Assistant Supervisor Patterson and Overseer Lee are capable of executing the work in question, yet, that it could not be entrusted to any one else, and their whole time and attention would have to be devoted to it, leaving their important duties as Superintendents wholly unattended to.

(Signed) P. Hamond, Colonel,
Principal Commissary of Ordnance.

Proceedings of a Committee assembled by order of the Principal Commissary of Ordnance to examine and report upon thirty two 32 Pdr. shot, cast at the Iron Works at Porto Novo and received through Messrs. Parry and Co.

President.—Sub-Conductor H. BRIGGS.

Members. { Sub-Conductor LEWIS.
Sub-Conduetor CASEY.

The Committee having assembled pursuant to order in the Grand Arsenal on the 3d December 1856, proceeded to examine and test the shot agreeably to the instructions conveyed in Arsenal Memorandum of the 29th ultimo.

The outward appearance of the shot appeared to the Committee very different to the shot supplied from England, having a roughened or burnt appearance, and a seaming of the metal often observable in lead castings.

The Committee procured three 32 Pdr. English shot and compared them with those under examination; the English shot were smooth on the surface. Not being aware of the appearance shot present immediately after removal from the moulds, the Committee were unable to determine whether the rough appearance observable in the Porto Novo shot, was equally liable in the English, but removed by after treatment, by rolling, filing, and polishing; to test this in some degree, the Committee had one of the Porto Novo shot filed clean and coated with a composition of linseed oil and black seed, a remarkable improvement in appearance followed, in fact, in outward appearance the shot became equally as good looking as the English.

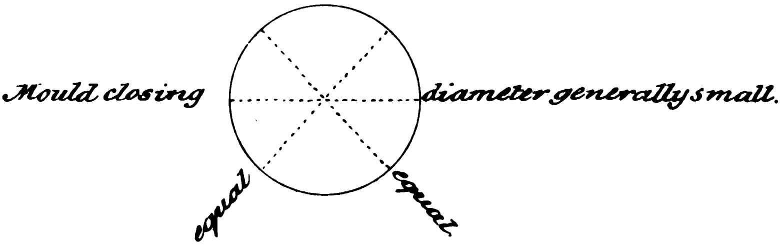
The Committee observed that the seaming of the metal and cindery appearance of some portions of the surface, was apparently owing to the shot being cast in sand moulds not sufficiently dry, or having sufficient vent for the escape of the heated air.

The Committee would respectfully remark that the shot received from England being cast in metal moulds, the surface appearance must be far superior to any that can be moulded in sand.—In the metal moulds ample means for the escape of the air is provided, and the moulds can be kept at the temperature best adapted for good casting.

The Committee consider the metal of which the Porto Novo shot are cast to be very good—one shot was thrown three times off the roof of the Military Board Office on to old iron guns, without being injured in any degree.

The weight of the shot is very good, varying from lbs. 31-13 to lbs. 32-4¼, while of three English shot weighed, the highest reached to lbs. 31-12 and the lowest lbs. 31-8. The specific gravity of the Porto Novo shot is therefore slightly superior to the English.

The shot were accurately measured, and the results are shewn in the annexed table.* The Committee observed that very few, perhaps none were perfectly spherical; the shortest diameters always being round the circumference where the moulds were closed; transverse measurements across this circumference were generally equal.



Two or three of the shot were very faulty, their want of sphericity being increased by partial risings on the surface, as if the inside of the mould had been pressed by a finger.—These shot would go through the high guage in some positions and stick in others, although the general diameter was nearly a tenth of an inch under the guage.

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* Page 52.

The opinion of the Committee is, that the shot have been cast without the founders fully understanding the extreme nicety required, but that if the faults now observed are pointed out to them, they can be easily rectified. Many amongst the shot are perfectly serviceable. The Committee would however beg to remark that any future supply should be scraped, cleaned, and slightly oiled by the founders, such work if thrown on the Arsenal would increase their cost, and it is work also belonging to the manufacturers and for which they are paid.

The Committee would respectfully suggest, that to ensure good castings, and perfect sphericity of form, Iron Moulds for each calibre should be made up in the Grand Arsenal, agreeably to the pattern proposed by Major Worster, and these moulds supplied to the founders on payment. The making of them is perfectly practicable, and if tested when at the proper temperature, the most correct and efficient projectile would be produced.

(Signed) H. BRIGGS, *Sub-Conductor.*
(Signed) D. CASEY, *Sub-Conductor.*
(Signed) E. LEWIS, *Sub-Conductor.*

(Signed) P. HAMOND, Colonel,
Principal Commissary of Ordnance.

Letter No. 683 *from Colonel P. Hamond, Principal Commissary of Ordnance to the Director Artillery Depot, dated* 14*th March* 1857.

Sir,—Referring to your Memorandum of yesterday's date, I have the honor to inform you, that the fragments of shot in question have been examined by Mr. Patterson, who pronounces the English Iron superior to that of Porto Novo, because it contains a larger amount of Carbon, and is therefore more fusible.

(Signed) P. HAMOND, Colonel,
Principal Commissary of Ordnance.

Table of Diameters and Weight of Porto Novo Shot.

No of Shot.	Diameters.		Weights.		Remarks.
	Ins.	Ins.	lbs.	ozs.	
1	6·19	6·14	32	0	Dont pass the low guage; through high in one position only, surface rough.
2	6·19	6·19	32	0	Surface full of small holes ·15 deep. Surface rough.
3	6·18	6·18	31	13¼	Rough and apparently burnt.
4	6·15	6·15	31	14¾	Guages correct. Surface rough in parts.
5	6·18	6·18	31	15	Surface full of holes. Some ·2 deep.
6	6·19	6·185	32	½	Surface rough in holes.
7	6·2	6·18	32	4¼	Does not pass through high guage in one position, does in the other. Surface rough in parts.
8	6·16	6·15	31	14¼	Surface rough no small holes.
9	6·18	6·15	31	15	Surface rough and mould marked.
10	6·17	6·13	31	14¼	Surface rough, two large cavities.
11	6·17	6·155	31	15	Surface tolerably good.
12	6·19	6·19	31	14	Surface rough.
13	6·17	6·17	31	14¾	Surface tolerably good.
14	6·17	6·17	31	14	Surface rough.
15	6·18	6·17	31	14	Surface rough and uneven.
16	6·18	6·18	31	15¾	Surface rough and uneven.
17	6·18	6·18	31	14½	Surface good.
18	6·19	6·19	31	14½	Surface rough.
19	6·18	6·18	32	0	Surface tolerably good.
20	6·16	6·16	31	14¼	Surface tolerably good.
21	6·19	6·195	32	0	Surface rough in parts. Will not pass through the high guages in every position.
22	6·185	6·185	31	15¼	Surface tolerably good.
23	6·175	6·175	32	3¼	High guage. Sticks in certain position. Surface tolerably good.
24	6·19	6·19	31	14¾	Surface good.
25	6·18	6·18	31	15½	Surface tolerably good, three large dinges.
26	6·19	6·16	31	15¾	Surface uneven in parts.
27	6·2	6·2	31	15¾	Surface tolerably good.
28	6·18	6·18	31	15¾	Surface tolerably good—one slight flaw.
29	6·17	6·17	31	14½	Surface tolerably good—one slight flaw.
30	6·165	6·165	31	14¼	Surface good.
31	6·17	6·17	31	15	Surface good.
32	6·165	6·165	31	14¾	Surface good.

Reports of Comparative trials of English 32 Pdr. Shot, and 32 Pdr. Shot cast at Porto Novo, in accordance with instructions conveyed in Extract of Proceedings of the Military Board No. 5478, dated 24th December 1856.

REPORT No. 1.

Ordnance.			English 32 Pdr. Shot.															32 Pdr. Shot cast at Porto Novo.															
Description.	Diameter of Bore.		Number.	Shot. Weight.		Shot. Diameter.		Windage.	Charge.	Elevation.		Time of Flight.		Recoil.		Distance to 1st Graze.	Medium Range.	Number.	Shot. Weight.		Shot. Diameter.		Windage.	Charge.	Elevation.		Time of Flight.		Recoil.		Distance to 1st Graze.	Medium Range.
	ins.	pts.		lbs.	ozs.	in.	pts.	pts.	lbs.	D	M	S.	P.	ft.	in	yds.	yards.		lbs.	ozs.	ins.	pts	pts.	lbs.	D	M	S.	P.	ft.	in	yards.	yards.
32 Pdr. Gun of 25 Cwt. Length 6 Feet.	6	30	5	32	1¼	6	·17	·13	4	P.	B.	,,	,,	8	,,	247	275	7	32	4¼	6	·20	·10	4	P.	B.	,,	,,	8	,,	339	317
			6	31	14¾	6	·18	·12		,,	,,	,,	,,	7	9	300		16	31	15¾	6	·18	·12		,,	,,	,,	,,	7	6	330	
			7	31	12¾	6	·17	·13		,,	,,	,,	,,	7	6	277		14	31	14	6	·17	·13		,,	,,	,,	,,	7	8	281	
			12	31	13	6	·18	·12		8	,,	8	30	7	8	2145	2142	22	31	15¼	6	·185	·115		8	,,	9	,,	7	6	2184	2125
			17	31	10½	6	·17	·13		,,	,,	8	,,	7	6	1957		25	31	15½	6	·18	·12		,,	,,	9	,,	7	6	2015	
			18	31	13	6	·19	·11		,,	,,	9	,,	7	9	2325		24	31	14¾	6	·19	·11		,,	,,	9	,,	7	8	2177	
			REPORT No. 2.																													
	6	30	1	31	9	6	·17	·13	4	6	,,	6	30	8	2	1670	1703	12	31	14	6	·17	·13	4	6	,,	6	30	8	,,	1675	1671
			2	31	6	6	·17	·13		,,	,,	6	30	8	2	1665		13	31	14	6	·17	·13		,,	,,	6	30	7	9	1683	
			3	31	5	6	·17	·13		,,	,,	7	,,	9	,,	1774		18	31	14¼	6	·17	·13		,,	,,	6	30	9	,,	1656	

REPORT No. 3.

Ordnance.			English 32 Pdr. Shot.														32 Pdr. Shot cast at Porto Novo.													
			Shot.														Shot.													
Description.	Diameter of Bore.		Number.	Weight.		Diameter.		Windage.	Charge.	Elevation.		Time of Flight.		Recoil.			Number.	Weight.		Diameter.		Windage.	Charge.	Elevation.		Time of Flight.		Recoil.		
	ins.	pts.	N	lbs.	ozs.	ins.	pts.	pts.	lbs.	D	M	S.	P.	ft.	in		N	lbs.	ozs.	ins.	pts.	pts.	lbs.	D	M	S.	P.	ft.	in	
32 Pdr. Gun of 25 Cwt. Length 6 Feet.	6	30	4	31	7½	6	·17	·13	4	1	,,	,,	,,	9	,,	Over centre of Target.	21	31	15½	6	·17	·13	4	,,	45	,,	,,	9	10	3 feet below centre of Target.
			5	31	8	6	·17	·13		,,	45	,,	,,	8	3	Bull's eye-grazed at 527 yards.	26	31	15½	6	·17	·13		,,	45	,,	,,	9	,,	Over. Grazed at 500 yards.
			6	31	8	6	·17	·13		,,	50	,,	,,	6	9	2½ feet below centre of Target grazed at 562 yards.	27	31	15½	6	·17	·13		1	,,	,,	,,	9	,,	Bulls eye.

MEMORANDUM.

A scarped face of a Rock sufficiently large, having been found among the Palaveram Hills, English and Porto Novo Shot were fired alternately at it at four different distances, one round of each description of shot at each distance. The nearest distance was about such as would be found with Breaching Batteries established on the crest of the glacis,—the longest distance which the ground admitted was 266 yards—In every instance, the shot was shattered into fragments, which flew in all directions; but the Porto Novo much more numerous and minute, and disclosing a very different quality of iron from that of the English Shot. The fragments have been forwarded to the Principal Commissary of Ordnance for submission to the opinion of competent judges.—Three rounds of each kind of shot were then fired at P. B. and at the extreme elevation obtainable, selecting the roughest surfaces of the Porto Novo, and smoothest of the English, to ascertain what might be the effect of the difference on their flight—Report No. 1.—Three rounds of each kind of as exactly simliar weight and diameter as could be selected, were then fired at a high elevation—Report No. 2—after which three rounds more of each kind were fired at a Target 12 feet square at 600 yards (by the same individual) to test the accuracy of direction—Report No. 3 —The result of the whole of the Trials is not unfavourable to the Porto Novo Shot; which it may be expected, due attention being given to the judicious suggestions offered in the Proceedings of the Committee of Warrant Officers at the Arsenal, of which Sub-Conductor Briggs was President,—will prove as effective, if not more so, (the guages in the manufactory being more directly under our own control) than that supplied from Europe.

(Signed) G. Rowlandson, Major, *Director Artillery Depot.*
(Signed) Æ. Shirreff, Brigadier, *Commandant of Artillery.*

Artillery Depot, St. Thomas' Mount, 13*th March* 1857.

Letter No. 7718 *from the Military Board, to Messrs. Parry and Co. dated* 25*th March* 1857.

Gentlemen,—With reference to your letter of 17th December 1856, I have the honor, by desire of the Military Board to enclose Copy of a Report from the Brigadier Commandant of Artillery, shewing the experiments to test the efficiency of the shot cast at Porto Novo.

2. You will observe that the Director of the Artillery Depot of Instruction, who conducted the experiments does not consider the experiments unfavourable to the Porto Novo shot; but you will also observe that they splintered much more than the English shot, and that the Iron is different, as may be expected.

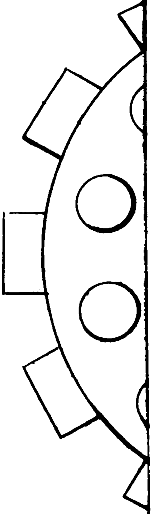
3. The Board are inclined to think that it would be well if you could obtain an analysis by an efficient Chemist of the Iron of the English and Porto Novo shot, and to this end the Board will give you every assistance in carrying this on.

4. If you desire to have some of the pieces of the two kinds of shot to send to England for examination, the Board will request the Principal Commissary of Ordnance to furnish you with pieces; and if the Indian Iron Company test the Iron, the Military Board recommend to their notice a very valuable work published by the authority of the United States Secretary at War, entitled, " Reports of Experiments on the strength and other properties of metals for Cannon" procurable at Trubner and Co., 12 Paternoster Row.

5. You will observe that the English and Porto Novo Projectiles have been taken as near as possible alike in gauge and weight, and on the whole the Board think that the test is sufficiently encouraging to induce your Company to proceed with the casting; but only if an experienced person be sent out from Home skilled in shot and shell casting, with all the knowledge lately gathered in England and the United States, as to the properties of Iron, and with proper moulds for all kinds of Projectiles, and the means of preparing other moulds, a successful result may be considered as certain.

(Signed) A. H. Hope, *Secretary.*

ound Shot
aves.



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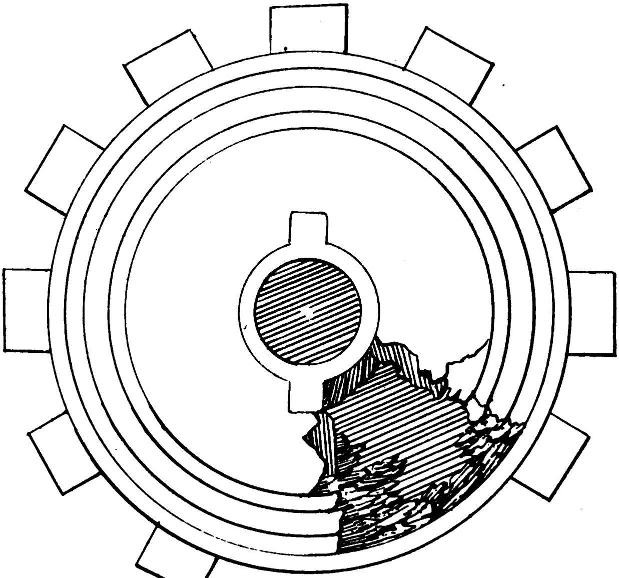

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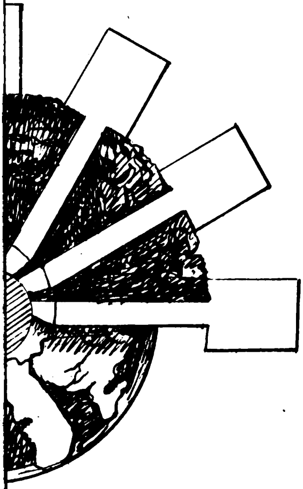


Mad 1 ft.

J. BINNY. LITHR.

Experimental Practice to ascertain the effects of Round Shot on Metal and Wooden Naves, both as affecting the stability of the wheel and the safety of the Detachment from splinters &c. (Plate 6.)

In accordance with the desire of His Excellency Sir P. Grant K. C. B., the Commander-in-Chief.—Experimental Practice as follows, took place in the Range at Artillery Head Quarters in the month of April 1857, to ascertain the effect of round shot fired against Brass Naves in use with the Madras Light Field Artillery, and the wooden naves in general use in Bengal, and also with Heavy Field Artillery in Madras.

1st. Two Shot from 6 Pdrs. at 300 yards distance struck a Madras metal (Brass) nave, sketch 1 ; the first shot struck the outer edge of the plate and cut its way clean through, leaving a hole exactly of its own diameter *(a.)*—The nave and wheel remained firm, and would have travelled notwithstanding.—The second shot struck nearer the centre on the same side of the same nave, sketch No. 2, grazing the projecting edge of the fixed Nave box and cut out a larger piece, still of the shape of the shot with the surrounding edges partially broken off *(b.)* and 4 spokes carried away ; but had not the tire, fellies and remaining spokes, been damaged by other shot, the wheel would apparently have continued to travel, sufficiently at least to reach a place of safety, even with this second hurt,—The whole of the rest of the nave and spokes remaining compact and unmoved, except where struck by other shot.

2nd. Three shot from the same pieces at a similar distance struck three wooden naves (each once only) of an old Heavy Field 12 Pdr. Carriage ; the wood of the naves of which was proved to be tolerably sound,—although the fellies had quite perished.—The first shot struck the face of the nave No. 3 fair, just within the Nave bands, and tore its way through the Nave leaving a large cavity and carrying away the rear nave box,—The whole wheel was dislocated—the spokes all involved in the damage, and with a weight on it, if not at once, certainly on movement, it would have fallen to pieces.—The second No. 4 struck on the outside swell of the nave,—cut both nave bands, and glancing off carried away three spokes; but it probably would have travelled for sometime notwithstanding if not otherwise injured;—The third No. 5 struck the edge of the nave band, and sliding inwards towards the centre, tore away the rear nave box and all the surrounding wood, laying bare the spokes in their mortices and the wheel a useless wreck.

The brass nave where struck was carried away in few and large pieces,—the wood on the contrary in innumerable splinters of varying size, which strewed the ground for some paces to the rear of the wheels.

The evidence thus obtained of the advantage of metal over wooden naves, in the particular points investigated by the above experiment, in addition to the numerous other points of superiority established by the results of upwards of 50 years uninterrupted use in the Madras Artillery, and repeatedly and clearly set forth in detail in the proceedings and discussions of the special Board of Artillery Officers in Calcutta in 1838-9, and subsequently in those of the Madras Permanent Artillery Select Committee, renders it a matter of surprize and regret, that the former are not universally adopted, and wooden naves discarded except for Heavy Field Carriages and carts for transport of all kinds &c.

(Signed) G. Rowlandson, Major,
Director Artillery Depot.

Report of Experiments carried on at Saint Thomas' Mount, with the undermentioned pieces of Ordnance fired from a Bed of Timber. The Bed was formed by six logs buried in the Ground, three on each side, the upper Log level with the surface, Trunnion holes were cut at various distances for the reception of the Ordnance.

Weight and Dimensions of Ordnance and Projectiles used during the following Experiments.

Nature of Ordnance.	Marks on the Ordnance.	Weight of Ordnance.			Bore.			Chamber.								Shot.			Shells common.				Remarks.
					Diameter.		Length of	Diameter.				Length of	Contents.		Shape.	Weight.		Diameter.	Number.	Diameter.	Weight.		
					Horizontal.	Vertical.		Supr. Horizontal.	Supr. Vertical.	Infer. Horizontal.	Infer. Vertical.												
		Cwt.	qrs.	lbs.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	lbs.	ozs.		lbs.	oz.	ins.		ins.	lbs.	ozs.	
8-Inch Iron Gun.....	1843 R. T. 389 L. T. M. Co.	65	..	20	8·05	8·05	105·27	8·05	8·05	5·8	5·8	13·44	..	..	Gomer.	..	..	7·85	..	7·81	46	..	
8-Inch Iron Howzr..	1846 R. T. Low Moor L. T. 3823	22	1	12	8	8	......	8	8	6	6	......	..	..	Gomer.	67	8	7·84	..	7·81	46	..	
8-Inch Iron Mortar...	307 s Bowling.	8	1	..	8·03	8·03	8	8	8	8	8	8	2	..	Gomer.	..	..	.....	..	7·81	46	..	
8-Inch Brass Mortar.	G. Hutchinson Ft. William No. 53.	6	2	22	8	8	13·5	4·1	4·1	....	....	7·2	2	4	Conical.	..	..	....	..	7·81	46	..	

8 INCH IRON GUN.

Date.	Rounds.	Charge.		Elevation.	Flight.		Distance Right.	Distance Left.	Range. Real.	Range. Medium	Remarks.
		oz.	drs.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
19th Septr.	1	4	....	45	6	30	line		199	227	
	2	,,	....	,,	7	....	....	2	233		
	3	,,	....	,,	7	....	line		228		
	4	,,	....	,,	7	....	2	....	238		
	5	,,	....	,,	7	....	1	....	233		
	6	,,	....	,,	7	....	....	2	227		
20th September, 1850.	1	8	....	45	11	30	....	10	596	562	
	2	,,	....	,,	11	....	....	4	539		
	3	,,	....	,,	10	....	....	1	516		
	4	,,	....	,,	11	....	....	4	556		
	5	,,	....	,,	11	....	5	....	562		
	6	,,	....	,,	11	....	....	7	605		
	1	12	....	45	14	....	35	....	933	936	
	2	,,	....	,,	14	30	....	26	1032		
	3	,,	....	,,	14	....	....	22	998		
	4	,,	....	,,	14	....	....	16	958		
	5	,,	....	,,	14	....	18	....	934		
	6	,,	....	,,	14	....	....	2	925		
23rd September 1850.		lbs.	oz.								
	1	1	....	45	....	....	....	7	1321	1313	
	2	,,	....	,,	17	....	....	73	1301		
	3	,,	....	,,	16	....	13	....	1300		
	4	,,	....	,,	16	....	18	....	1322		
	5	,,	....	,,	16	....	42	....	1332		
	6	,,	....	,,	16	....	....	6	1303		
	1	1	....	45	14	30	....	12	1007	984	Solid Shot.
	2	,,	....	,,	14	....	10	....	1006		,,
	3	,,	....	,,	13	30	....	14	939		,,
24th September 1850.	1	1	4	45	20	....	26	....	1658	1638	
	2	,,	,,	,,	20	....	115	....	1691		
	3	,,	,,	,,	19	....	156	....	1586		
	4	,,	,,	,,	19	30	44	....	1599		
	5	,,	,,	,,	20	....	....	2	1626		
	6	,,	,,	,,	20	....	26	....	1672		
	1	1	....	45	12	30	1	....	793	....	Hollow shot filled with lead, Weight 79½ lbs.
	1	1	8	45	21	....	42	....	1926	1908	
	2	,,	,,	,,	21	....	61	....	1906		
	3	,,	,,	,,	21	15	91	....	1927		
	4	,,	,,	,,	21	....	....	110	1858		
	5	,,	,,	,,	21	....	58	....	1895		
	6	,,	,,	,,	22	....	36	....	1931		
25th Sept. 1850	1	1	12	45	22	....	30	....	2226	2132	
	2	,,	,,	,,	22	....	75	....	2224		
	3	,,	,,	,,	20	....	200	....	1956		
	4	,,	,,	,,	22	....	line		2252		
	5	,,	,,	,,	21	....	80	....	2068		
	6	,,	,,	,,	21	....	200	....	2069		

8 INCH IRON GUN *(CONTINUED.)*

Date.	Rounds	Charge.		Elevation.	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		lbs.	oz.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
26th Sept. 1850	1	2	....	45	25	30	....	70	2536	2193	
	2	,,	....	,,	25	30	....	90	2566		
	3	,,	....	,,	25	....	line		2476		
	4	,,	....	,,	25	....	300	....	2456		
	5	,,	....	,,	24	....	70	....	2131		
27th Sept. 1850.	1	....	4	45	6	....	line		178	....	
	1	2	4	45	25	30	50	....	2826	2736	
	2	,,	,,	,,	25	....	....	30	2736		
	3	,,	,,	,,	25	....	250	....	2766		
	4	,,	,,	,,	24	....	150	....	2657		
	5	,,	,,	,,	25	....	100	....	2776		
	6	,,	,,	,,	24	....	120	....	2636		
1st Oct. 1850	1	2	8	45	27	....	140	....	2975	2958	
	2	,,	,,	,,	27	30	....	50	3006		
	3	,,	,,	,,	27	....	....	170	2957		
	4	,,	,,	,,	27	....	80	....	2945		
	5	,,	,,	,,	26	30	....	100	2906		
	6	,,	,,	,,	27	....	100	....	2956		
2d Oct. 1850.	1	2	12	45	28	....	....	200	3057	3154	
	2	,,	,,	,,	29	....	100	....	3216		
	3	,,	,,	,,	28	....	150	....	3134		
	4	,,	,,	,,	28	30	50	....	3266		
	5	,,	,,	,,	28	....	....	40	3068		
	6	,,	,,	,,	28	....	....	250	3156		

8 INCH IRON HOWITZER.

Date.	Rounds.	Charge.		Elevation.	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		ozs.	drs.	D	sec.	pts.	yds.	yds.	yards.	yards.	
19th Sept. 1850.	1	4	....	45	7	....	....	2	275	282	
	2	,,	....	,,	7	30	....	1	281		
	3	,,	....	,,	7	15	....	1	262		
	4	,,	....	,,	7	45	line		292		
	5	,,	....	,,	8	....	2	....	298		
	6	,,	....	,,	8	....	1	....	282		
20th Sept. 1850	1	8	....	45	11	....	....	5	570	566	
	2	,,	....	,,	12	....	....	11	618		
	3	,,	....	,,	10	30	....	1	515		
	4	,,	....	,,	11	30	....	24	598		
	5	,,	....	,,	11	....	....	2	575		
	6	,,	....	,,	10	30	....	10	518		

8 INCH IRON HOWITZER *(CONTINUED.)*

Date.	Rounds.	Charge.		Elevation.	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		ozs.	drs.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
20th Sept. 1850	1	12	....	45	13	....	....	4	846	846	
	2	,,	....	,,	13	....	32	....	866		
	3	,,	....	,,	13	....	14	....	860		
	4	,,	....	,,	13	....	....	18	833		
	5	,,	....	,,	13	....	....	37	832		
	6	,,	....	,,	13	....	....	31	840		
23d Sept. 1850.		lbs.	oz.							1087	
	1	1	....	45	....	....	12	....	1179		
	2	,,	....	,,	....	....	....	7	1155		
	3	,,	....	,,	15	....	10	....	1022		
	4	,,	....	,,	15	....	....	40	1088		
	5	,,	....	,,	15	....	....	58	1005		
	6	,,	....	,,	15	....	....	13	1070		
24th September 1850.	1	1	4	45	17	....	92	....	1396	1411	
	2	,,	,,	,,	17	30	....	47	1406		
	3	,,	,,	,,	17	....	88	....	1402		
	4	,,	,,	,,	18	....	....	19	1484		
	5	,,	,,	,,	17	....	74	....	1353		
	6	,,	,,	,,	18	....	....	64	1425		
	1	1	8	45	19	15	60	....	1696	1666	
	2	,,	,,	,,	19	....	40	....	1675		
	3	,,	,,	,,	20	....	54	....	1624		
	4	,,	,,	,,	19	....	24	....	1648		
	5	,,	,,	,,	19	....	....	50	1615		
	6	,,	,,	,,	19	45	....	70	1708		
25th Sept. 1850	1	1	12	45	22	....	146	....	2006	1993	
	2	,,	,,	,,	20	....	54	....	1906		
	3	,,	,,	,,	20	30	....	60	1936		
	4	,,	,,	,,	22	....	50	....	2015		
	5	,,	,,	,,	22	....	....	70	2012		
	6	,,	,,	,,	23	....	2	....	2081		
26th Sept. 1850	1	2	....	45	24	....	....	60	2156	2213	At the 4th round, the log of timber was splintered in rear of the right trunnion, the piece about 2 ft. in length was found to be decayed.
	2	,,	....	,,	24	....	....	2	2246		
	3	,,	....	,,	23	....	90	....	2196		
	4	,,	....	,,	23	30	....	100	2256		
27th Sept. 1850.	1	....	4	45	6	30	....	3	258	....	
	1	2	4	45	24	....	....	158	2466	2452	
	2	,,	,,	,,	25	....	....	200	2528		
	3	,,	,,	,,	25	....	....	100	2517		
	4	,,	,,	,,	23	30	....	10	2436		
	5	,,	,,	,,	24	....	line		2408		
	6	,,	,,	,,	23	....	....	19	2356		
1st Oct. 1850	1	2	8	45	26	....	100	....	2715	2704	
	2	,,	,,	,,	26	30	30	....	2786		
	3	,,	,,	,,	26	....	....	200	2744		
	4	,,	,,	,,	25	....	....	390	2646		
	5	,,	,,	,,	25	30	....	3	2686		
	6	,,	,,	,,	25	....	....	380	2647		

8 INCH IRON HOWITZER *(CONTINUED.)*

Date.	Rounds.	Charge.		Elevation.	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		lbs.	oz.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
2d Oct. 1850.	1	2	12	45	28	....	....	160	2916	2894	
	2	,,	,,	,,	28	....	line		2945		
	3	,,	,,	,,	27	....	180	....	2886		
	4	,,	,,	,,	27	30	180	....	2906		
	5	,,	,,	,,	26	....	246	....	2787		
	6	,,	,,	,,	27	....	....	410	2926		

8 INCH IRON MORTAR.

Date.	Rounds.	Charge.		Elevation.	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		ozs.	drs.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
19th Sept. 1850	1	4	....	45	4	30	15	....	124	127	
	2	,,	....	,,	4	30	6	....	122		
	3	,,	....	,,	5	....	5	....	138		
	4	,,	....	,,	4	45	4	....	130		
	5	,,	....	,,	4	30	6	...	119		
	6	,,	....	,,	5	....	6	....	126		

8 INCH BRASS MORTAR.

Date.	Rounds.	Charge.		Elevation	Flight.		Distance		Range.		Remarks.
							Right.	Left.	Real.	Medium	
		oz.	drs.	D.	sec.	pts.	yds.	yds.	yards.	yards.	
19th Sept. 1850.	1	4	....	45	5	30	....	2	182	195	
	2	,,	....	,,	6		line.		184		
	3	,,	....	,,	6		line.		196		
	4	,,	....	,,	6		....	4	197		
	5	,,	....	,,	7		line.		206		This Shell broke the shell of the 3rd round which it struck.
	6	,,	....	,,	7		line.		202		

(Signed) A. F. **Oakes**, Captain,
Director Artillery Depot.

(Signed) F. F. **Whinyates** Brigadier,
Commandant of Artillery.

Artillery Depot
Saint Thomas' Mount,
22nd November, 1850.

Report of ***Experiments*** *with the undermentioned Projectiles invented by Mr. Kennedy, and forwarded for experiment and report by the Principal Commissary of Ordnance, Letter No.* 1496, *dated* 22*d April* 1858.

Date.	Ordnance.		Rounds.	Charge		Elevation.	Projectiles.				Recoil.		Targets Distance.	Remarks.
	Description.	Diameter of Bore.					Description.	Weight.	Diameter.	Bursting Charge.				
		Inches.		lbs.	ozs.	deg.		lbs.	ins.		feet.	ins.	yds.	
21st May 1858.	6 Pdr. Iron Gun on Iron Garrison Truck Carriage	3·71	1	2	....	P. B.	Spherical Ball.	6--3--0	3·64	......	1	3	200	Grazed in front, and passed to right of target—2d graze 500 yards.
			2	”	”	¼	Do.	”	”	......	1	2	”	Over the target and grazed at 700 yards.
			3	”	”	P. B.	Spherical Shell.	6--4--0	3·70	From 2 ozs. to 2 ozs. 9 drs.	1	..	”	Only entered the gun 18 inches—Grazed at 175 yards and passed through target 2 feet from bottom—Did not burst.
22d May 1858.	6 Pdr. unserviceable Brass Gun on wooden 6 Pdr. Carriage.	3·79	1	1	8	P. B.	Do.	”	”		2	..	100	Through the target—not burst—grazed at 150 yds.
			2	”	”	”	Do.	”	”		3	..	”	Do. Do. Do.
			3	”	”	”	Do.	”	”		3	6	200	Missed—grazed at 600 yards—did not burst.
			4	”	2	11¼	Conoidal Shell.	13-3-0	3·62	......	1	..	”	Struck the target—vide Para. 2 “ REMARKS”
			5	1	8	P. B.	Spherical Shell.	6-4-0	3·70	From 2 ozs. to 2 ozs. 9 drs.	3	..	”	Missed—grazed at 900 yards—did not burst.
			6	”	”	”	Do.	”	”		2	2	”	Missed—1st graze 800 yards—did not burst.
			7	”	”	Depressed.	Do.	”	”		2	6	”	Hit—through target—1st graze 290 yards.
			8	”	”		Do.	”	”		3	..	”	Hit—through target—1st graze 230 yards.

The five first rounds were fired by means of a piece of portfire fixed to the vent with clay.

ts.

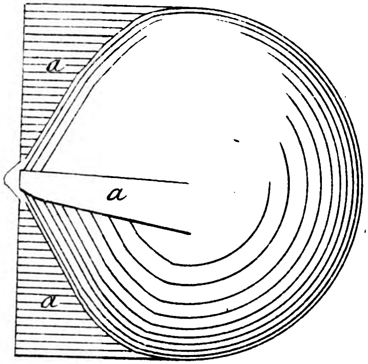
2-6

Plate 8.

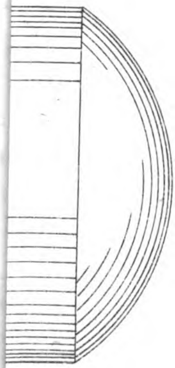
dy.

Spherical Ball.

Side View.



lbs. oz.
Weight 6–3



ol.

h a l funnel pour in
on ssion Cap.

W.R.F.

REMARKS.

1.—The above projectiles were fired against Mangoe-wood targets, 1 inch thick, 18 feet broad and 12 feet high. Each description had cast with them four projections of the same metal as the projectile itself, on the principle of the feathers of an arrow, by which it was supposed that when freed from the muzzle, the action of the air would give them the spiral motion.—The diameter of the Spherical Shells was so high (3·70) that they would not enter the Iron 6 Pdr. gun, and it was not deemed advisable to risk injuring a serviceable Brass 6 Pdr. gun by the metal projections.—None of the shells exploded, and the perforations in the target (sketch accompanying*) of such as struck, distinctly exhibits the opening to have been made by the shell striking laterally.—Of the 7 Spherical shells fired on the 22d May, 6 were recovered, one was uninjured and 5 were broken in the flanges and nipples.—One shell was filled with powder and fired on the ground by attaching a small piece of portfire—the brass-nipple and an iron plug at the opposite end were blown out, but the shell otherwise remained entire.

2.—A Conoidal shell weighing lbs. $13\frac{3}{16}$ was fired at an elevation of $11\frac{1}{4}$°, with a charge of 2 ozs., for the purpose of observing its course during flight. On leaving the muzzle of the gun, it made a series of continuous longitudinal revolutions until it struck the target, which it did sidewise.—The weight of this projectile would render it useless for a 6 Pdr. gun.

3.—On examining the Brass gun after the above firings, the bore appeared to have been considerably scored.

4.—From the above trial it would seem that the expectations of the inventor have entirely failed of realization.

ARTILLERY DEPOT,
ST. THOS.' MOUNT,
26th May 1858.

(Signed) G. BRIGGS, Major,
Acting Director Artillery Depot.

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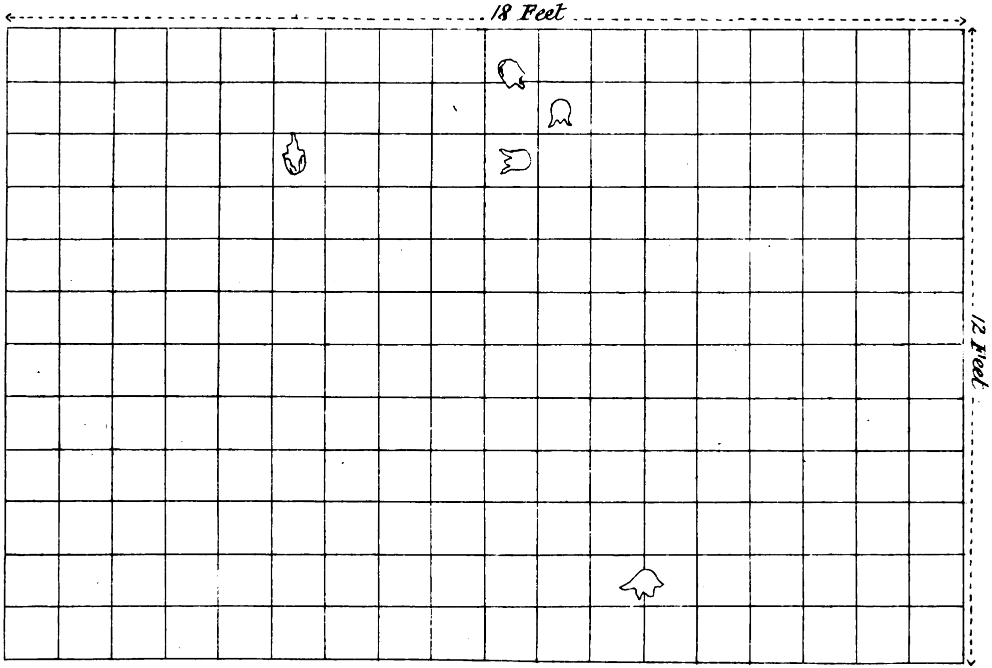
* See following page.

Sketch of Target.



Arty. Depot St. Thos. Mount
26th. May 1858.

(Signed) G. Briggs M[illegible]
[illegible]

P

n *Shrapnell Shell, Spherical Case Shot, and Improved Shrapnell.*

›ved Shrapnell.						
t.						
Empty.		Bursting Powder.		No. of Balls in each.	Marks on the Ordnance.	Marks on the Carriages.
	ozs.	ozs.	drs.			
11	11	1	9½	115 Musket.	A. Broome 1852, Cossipore No. 239.	I. M. 1848. No. 2.
11	11	1	9½	115 Musket.	A. Broome 1850, Cossipore No. 209.	I. M. 1848. No. 1.
5	15½	1	0½	76 Carbine.	A. Broome 1856, Cossipore No. 285.	I. M. 1854. No. 9.
5	15½	1	0½	76 Carbine.	A. Broome 1856, Cossipore No. 280.	I. M. 1843. No. 5.

Report of Exp|*Ordnance, carried on at Artillery Head Quarters*
in presenc|*nance and Magazines, as per Letter No.* 8499
dated 15*t*|*nts.—Each line was* 100 *feet long,* 10 *feet high,*
and place|

Date.			1st Target's Distance.	Where burst and Remarks.
5th August 1858.	Brass Howitzers.	24		Between 1st and 2d Targets.
		24		Grazed at 800 yards passed through 1st and 2nd Targets and burst at 1200 yards.
		12		Over the 1st Target.
		12		Over the 1st Target.
		24		Between 1st and 2nd Targets.
		24		Between 2nd and 3rd Targets.
		12		At the 2nd Target.
		12		Between 1st and 2nd Targets.
		24		20 yards in front of 1st Target.
		24		Between 1st and 2nd Targets.
		12		Burst at 850 yards.
		12		Beween 1st and 2nd Targets.
		24		Over the 1st Target.
		24		Grazed at 850 yards passed through 1st Target and burst between the 2nd and 3rd
		12		Burst at 750 yards.
		12		Burst at 850 yards.
		24		Passed through 2nd Target and burst between 2nd and 3rd.
		24		Grazed at 780 yards and burst between 1st and 2nd Targets.
		12		Burst at 850 yards.
		12		Between 1st and 2nd Targets.
		24		Burst at 850 yards.
		24		Between 1st and 2nd Targets.
		12		Burst at 830 yards.
		12		Between 2nd and 3rd Targets.
		24		Between 2nd and 3rd Targets.
		24		Grazed at 800 yards, passed over the Targets, *did not burst.*
		12		Over the 1st Target.
		12		At the 1st Target.

Total No. of Balls that passed through the Targets.................. 717
" " " lodged in or struck " 605
" " Splinters that passed through " 69
" " " lodged in or struck " 27

through.			No. of Balls in the Shells.			1st Target's distance.	Where burst and Remarks.
	3rd "	Total.	That burst.	Not burst.	Total.		
15	1	98	1674	256	1930	1000 yards.	Burst at 900 yards.
							Burst at 970 yards.
11	1	23					Burst over the 1st Target.
							Passed through 2nd Target, *did not burst.*
16	7	23					Grazed at 925 yards, *did not burst.*
							Burst over 1st Target.
12	5	36					Passed through 2nd Target, *did not burst.*
							Burst at 950 yards.
3	0	3					BURST 40 YARDS IN FRONT OF THE MUZZLE.
							Passed through 1st Target, and burst between 1st and 2nd.
17	2	19					Passed through 1st Target, and burst between 1st and 2nd.
							BURST AT THE MUZZLE.
22	3	94					Burst at 930 yards.
							Burst at 980 yards.
30	11	41					Burst over 2nd Target.
							Burst over 1st Target.
26	25	63					Burst at 960 yards.
							Burst over 1st Target.
28	10	38					Burst over 1st Target.
							Burst at 950 yards.
80	65	438					

Total No. of Bullets that passed through the Targets..........438.
" " lodged in or struck " ....435.
" Splinters that passed through " ....43.
" " lodged in or struck " ....0.

Date.	Ordnance used.	Where burst and Remarks.
11th August 1858.	Brass Howitzers.	24 Poundeat 950 yards.
		24 Poundeen 1st and 2nd Targets.
		12 Poundeen 1st and 2nd Targets.
		12 Poundehe 1st Target.
		24 Pounded at 925 yards, and burst at yards.
		24 Poundeat 1060 yards.
		12 Poundeat the 1st Target. To the right.
		12 Pounded at 950 yards, and passed to right, *did not burst.*
		24 Poundeat 1050 yards.
		24 Poundeen 1st and 2nd Targets.
		12 Poundeen 1st and 2nd Targets.
		12 Poundeen 1st and 2nd Targets to the t.
		24 Poundeat 1050 yards.
		24 Pounded at 900 yards, and burst at yards.
		12 Poundehe 1st Target.
		12 Poundeat 1070 yards.
		24 Pounded at 950 yards, and burst at yards.
		24 Poundeat 1040 yards.
		12 Pounded at 1025 yards, and burst 1st Target.
		12 Pounded at 970 yards, and burst at yards.

Total No. of Bullets that passed through the Targets... 178
" " " lodged in or struck " 372
" " Splinters that passed through " 43
" " " " lodged in or struck " 3

Balls through.				No. of Balls in the Shells.				
1st Target.	2nd "	3rd "	Total.	That burst.	Not burst.	Total.	1st Target's Distance.	Where burst and Remarks.
16	1	0	17	1867	63	1930	1100 yards.	Burst at 980 yards.
								Burst at 1000 yards.
26	2	0	28					Burst between 1st and 2nd Targets.
								Burst at 1000 yards.
15	3	13	31					Burst at 970 yards.
								Burst at 1040 yards.
14	11	13	38					Burst at 1060 yards.
								Burst at 1000 yards.
10	3	0	13					Burst at 960 yards.
								Burst at 1040 yards.
2	1	2	5					Burst at 950 yards.
								Burst at 1000 yards.
15	12	3	30					Burst at 1080 yards.
								Burst at 1050 yards.
33	5	1	39					Burst at the 1st Target.
								Grazed near and passed through the 3rd Target, *did not burst.*
0	8	12	20					Burst at 1060 yards.
								Burst at 930 yards.
8	15	5	28					Burst at 1050 yards.
								Burst over the 1st Target.
39	61	49	249					

Total No. of Balls that passed through the Targets........ 249
" " lodged in or struck " 290
" " Splinters " passed through " 15
" " " " lodged in or struck " 4

Date.	Ordnance used.		Where burst and Remarks.
13th August 1858.	Brass Howitzers.	24 Pounder	at 1100 yards.
		24 Pounder	at 1125 yards.
		12 Pounder	en 1st and 2nd Targets, high.
		12 Pounder	at 1120 yards.
		24 Pounder	the 3rd Target.
		24 Pounder	d through the 3rd Target, *did burst.*
		12 Pounder	at 1150 yards.
		12 Pounder	en 2nd and 3rd Targets.
		24 Pounder	over 2nd Target, to the right.
		24 Pounder	at 1170 yards.
		12 Pounder	at 1150 yards, to the right.
		12 Pounder	at 1160 yards, to the left.
		24 Pounder	1st Target, to the right.
		24 Pounder	1st Target, to the left.
		12 Pounder	at 1150 yards, to the left.
		12 Pounder	en 1st and 2nd Targets.
		24 Pounder	in line with the 1st Target, pass- o the right.
		24 Pounder	in line with the 2nd Target, to right.
		12 Pounder	at the 1st Target 21 *balls through* 23 *indentations.*
		12 Pounder	d at 1150 yards, passed to the t, and *did not burst.*

Total No. of Balls that passed through the Targets	**82**
„ „ „ lodged in or struck „	**193**
„ „ Splinters that passed through „	**14**
„ „ „ lodged in or struck „	**2**

Balls through.				No. of Balls in the Shells.			1st Target's distance.	Where burst and Remarks.
1st Target.	2nd "	3rd "	Total.	That burst.	Not burst.	Total.		
38	0	0	38	1804	126	1930	1200 yards.	Burst at 1150 yards.
								BURST 50 YARDS IN FRONT OF MUZZLE.
0	0	18	18					Grazed 70 yards in rear of 3rd Target, *did not burst.*
								Burst between 2nd and 3rd Targets.
0	0	0	0					Burst 30 yards in rear of 3rd Target.
								BURST AT THE MUZZLE.
0	0	0	0					Burst over 3rd Target.
								Burst over 3rd Target.
6	2	9	17					Burst at 1190 yards.
								Burst 50 yards in rear of 3rd Target.
0	7	3	10					Burst over 3rd Target.
								Burst between 1st and 2nd Targets—high.
0	0	0	0					Burst 10 yards in front of 3rd Target—high.
								Burst 25 yards in front of 3rd Target—high.
0	0	6	6					Burst between 2nd and 3rd Targets—to the right.
								Burst 50 yards in rear of 3rd Target.
0	0	0	0					Burst over 2nd Target—high.
								Burst 20 yards in front of 2nd Target—high.
0	1	11	12					Burst between 1st and 2nd Targets—to the right.
								Grazed 50 yards, in rear of 3rd Target—*did not burst.*
44	10	47	101					

Total No. of Balls that passed through the Targets.........101
" " " lodged in or struck " 110
" Splinters that passed through " 8
" " lodged in or struck " 1

Date.	Ordnance used.		Where burst and Remarks.
23rd August 1858.	Brass Howitzers.	24 Pound	
		24 Pound	azed at 730 yards and burst at 890.
		12 Pound	rst at 750 yards.
		12 Pound	rst (100 yards, in front of 1st Tar- et,) at 800 yards.
		24 Pound	sed through 1st Target, and burst etween 1st and 2nd.
		24 Pound	rst at 750 yards.
		12 Pound	st at 850 yards.
		12 Pound	st over 1st Target.
		24 Pound	st between 1st and 2nd Targets.
		24 Pound	st at 730 yards.
		12 Pound	st at 880 yards.
		12 Pound	st at 750 yards.
		24 Pound	st over 1st Target.
		24 Pound	zed at 750 yards, and burst at 780 rds.
		12 Pound	t at 790 yards.
		12 Pound	t at 875 yards.
		24 Pound	t at 825 yards.
		24 Pound	t at 880 yards.
		12 Pound	t at 870 yards.
		12 Pound	t at 750 yards.
		24 Pound	fuze started at 850 yards and the ll passed over the Targets *with- bursting*.
		24 Pound	at 830 yards.
		12 Pound	at 820 yards.
		12 Pound	between 1st and 2nd Targets.
		24 Pound	at 890 yards.
		24 Pound	d through 1st and burst at 2nd get.
		12 Pound	at 850 yards.
		12 Pound	d and burst at 850 yards—to the at 800 yards.

Total No. of Balls that passed through the Targets........ 445
" " " lodged in or struck " 425
" " Splinters that passed through " 57
" " " lodged in or struck " 3

alls through.				No. of Balls in the Shells.				
	2nd „	3rd „	Total.	That burst.	Not burst.	Total.	1st Target's distance.	Where burst and Remarks.
9	0	3	12	1834	76	1910	1000 yards.	Grazed at 900 yards, and burst at 930. Grazed at 930 yards, and burst at 980.
0	1	0	1					Grazed at 995 yards, passed through 1st Target, *did not burst.* Fuze not ignited. Burst over the 1st Target.
43	0	0	43					Burst at 980 yards. Burst at 870 yards.
0	0	0	0					Burst between 1st and 2nd Targets. Grazed at 930 yards, and burst over 1st Target.
2	9	21	32					Burst at 830 yards. Burst between 2nd and 3rd Targets.
30	2	1	33					Burst at 1st Target. Grazed at 900 yards, and burst at 1st Target.
20	3	2	25					Burst at 840 yards, Burst at 830 yards—right.
0	4	1	5					Grazed at 940 yards, and burst between 1st and 2nd Targets. Burst over 2nd Target.
3	4	9	16					Burst at 870 yards. Grazed at 880 yards, passed through the 1st Target and burst in rear of it.
2	4	1	7					Burst at 900 yards. Burst at 930 yards.
100	27	38	174					

Total No. of Balls that passed through the Targets.......................174
„ „ „ lodged in or struck „ 239
„ Splinters that passed through „ 38
„ „ lodged in or struck „ 0

Date.	Ordnance used.		Where burst and Remarks.
25th August 1858.	Brass Howitzers.	24 Pounder	at 920 yards.
		24 Pounder	at 1030 yards.
		12 Pounder	between 1st and 2nd Targets.
		12 Pounder	at 1000 yards.
		24 Pounder	d and burst at 1020 yards.
		24 Pounder	between 1st and 2nd Targets.
		12 Pounder	over 1st Target.
		12 Pounder	at 1075 yards.
		24 Pounder	at 1050 yards.
		24 Pounder	at 1090 yards.
		12 Pounder	at 1030 yards.
		12 Pounder	at 1075 yards.
		24 Pounder	at 1050 yards.
		24 Pounde	d at 950 yards and burst in rear st Target.
		12 Pounde	at 950 yards.
		12 Pounde	between 1st and 2nd Targets.
		24 Pounde	at 970 yards.
		24 Pounde	at 1040 yards.
		12 Pounde	at 1000 yards.
		12 Pounde	between 1st aad 2nd Targets.

Total No. of Balls that passed through the Targets.........	182
„ „ „ lodged in or struck „	204
„ „ Splinters „ passed through „	32
„ „ „ „ lodged in or struck „	1

Balls through.				No. of Balls in the Shells.				
1st Target.	2nd ,,	3rd ,,	Total.	That burst.	Not burst.	Total.	1st Target's Distance.	Where burst and Remarks.
17	0	0	17	1489	421	1910	1200 yards.	Burst at 1130 yards.
								Burst at 1070 yards.
0	9	1	10					Burst between 1st and 2nd Targets.
								Burst between 1st and 2nd Targets right.
1	0	5	6					Burst over 1st Target.
								Fuze started at 1000 yards—*did not burst.*
0	0	0	0					Burst between 1st and 2nd Targets—very high.
								Grazed 50 yards in rear of 3rd Target, *did not burst.*
55	0	5	60					Burst at 1190 yards.
								Grazed at 1185 yards, and burst at 1st Target.
0	2	1	3					Burst over 1st Target, very high.
								Burst at 1150 yards.
0	4	3	7					Burst at 1160 yards.
								Grazed and Fuze started at 20 yards, in rear of 3rd Target—*did not burst.*
2	4	1	7					Grazed at 1000 yards, and burst at the 1st Target.
								Burst at 1150 yards.
7	8	3	18					Passed through 2nd Target, fuze started—*did not burst.*
								Burst at 1180 yards.
0	3	2	5					Burst at 1140 yards.
								Burst over 1st Target—left.
82	30	21	133					

Total No. of Balls that passed through the Targets...... 133
,, ,, ,, lodged in or struck ,, ... 160
,, ,, Splinters that passed through ,, ... 33
,, ,, ,, lodged in or struck ,, ... 4

Abstract of the foregoing Practice.

	900 yards.			1000 yards.			1100 yards.			1200 yards.		
	Diaphragm Shrapnell.	Spherical Case Shot.	Improved Shrapnell.	Diaphragm Shrapnell.	Spherical Case Shot.	Improved Shrapnell.	Diaphragm Shrapnell.	Spherical Case Shot.	Improved Shrapnell.	Diaphragm Shrapnell.	Spherical Case Shot.	Improved Shrapnell.
Total No. of Balls through the Targets......................	717	1097	445	238	438	174	178	247	182	82	101	133
" " that lodged or struck......................	605	768	425	400	435	239	372	290	204	193	110	160
" Splinters through the Targets......................	69	58	57	31	43	38	43	15	32	14	8	38
" " that lodged or struck......................	27	8	3	3	0	0	3	4	1	2	1	4

REMARKS.

I. Although this experiment has been carried on as far as possible under like conditions with each description of shell, yet so many unavoidable contingencies do occur in Ordnance practice, that it seems scarcely possible to come to a definite conclusion as to the absolute superiority of one kind of projectile over the other in the course of a trial so limited, more particularly if other considerations such as adaptability for travelling &c. are taken into account.

II. A few of the most prominent features of the characteristics of each description of shell (in firing only) are subjoined, deduced from actual observation.

III. Captain Boxer's hope was, that he would by construction be enabled so to place the centre of gravity of the Diaphragm Shell, that its bursting charge would always continue during flight in such a position as to burst the projectile with the best effect. Experience has shewn that with these particular shells this is not realized,—for, by firing the first round each morning in the twilight it was clearly seen that the projectiles performed a series of revolutions from the moment of leaving the muzzle of the piece till they struck the target or burst, consequently the force of the bursting powder counteracting (in all cases except when the fuze chanced to be in rear of the shell) the impetus communicated to the enclosed bullets on the discharge of the projectile from the piece; the balls therefore when the shell burst, did not continue the trajectory but were driven with more or less force out of their path in a direction opposite to the position of the fuze at the moment of the bursting of the shell,—as the following examples will show :—

Fuze *above* at moment of bursting.

1. The balls were frequently seen to fall with considerable force *perpendicularly* on the ground immediately under the spot where the shell burst, whilst the splinters of the shell passed on and went through or struck the target.

Fuze *below*.

2. In one instance the shell bursting in the first target, the balls were seen to rise in the air in the form of a curve which carried them over the 2nd target and up to the 3rd or beyond it.

Fuze *in front*.

3. One 24 Pounder Howitzer Shell burst in contact with the first target, leaving its diaphragm embedded in the wood in such a position as to show that the shell struck fuze foremost—the greater part of the balls were thrown back in the direction of the Battery, 27 of which were found close to the spot.

4. Diaphragm Shells were also fired in a state of rest with the fuzes placed both horizontally and vertically—in the former case the balls, and generally the lower half of the shell, were projected in a direction opposite to the fuze to a distance varying from 10 to 30 yards—in the latter the balls were found in the hole made in the ground by the bursting of the shell where the bottom of the shell was also discovered. Pieces of the shell flew about and were picked up as far as 50 yards distance from the spot.

IV. After the conclusion of the practice, in an enclosure 10 feet square formed of four of the targets with a roof and flooring of the same, Diaphragm Shells were fired from a tripod 5 feet from the ground and exactly in the centre of the wooden enclosure. In one case (the fuze being horizontally placed and towards the entrance of the enclosure) the wooden bottom with a large portion of the shell adhering to it, and all the balls (except 8 or 10) were driven through the opposite side of the building, half a plank having been forced out—some of the balls flying to a distance of nearly 25 yards.—When the fuze was vertical the wooden bottom and part of the shell broke the edge of one of the planks in the floor—the balls were scattered all about the room, none having penetrated the wood in the slightest degree.

V. The Boxer's fuzes were generally very good—they are very simple, and easily adjusted and quickly set in the shell, with very few instruments compared with the number of appliances required for common fuzes. They have the disadvantage however of only being capable of boring to full tenths, the use of fractional parts being impracticable. The practice with the Diaphragm Shell was very wild and uncertain, and deflections to right and left were often observed near the end of their range in a manner that might be termed *capricious* and unaccountable—seeing that the common Spherical Case Shot, as well as the Improved Shell from the same pieces and in a similar state of atmosphere, did not deviate from their course in the same manner.

VI. The balls from the Diaphragm Shell do not spread so much to right and left as with either of the other projectiles used,—on the occasions alluded to in para. 2 to the by-standers near the targets, they gave the idea of a flight of small birds in describing the curve through the air.

VII. Although the English cast balls are very much harder than those used for the common Spherical Case Shot, which are of lead only, their penetration through the targets was not generally equal to the latter, consequent probably on their decreased weight in alloying lead with a harder metal.

VIII. The number of Diaphragm Shells which did not burst was greater than that of either of the other descriptions of shells, the relative proportions being as per margin.* Of 8 Diaphragm Shells recovered, it was found on examination that the fuzes of 7 had not ignited—the other fuze *had* ignited and burnt itself out—the shell was cut open and the powder ascertained to have escaped through an aperture at the edge of the diaphragm, and become mixed with the coal dust surrounding the leaden balls. The whole of the Diaphragm Shells, however, which have been used appear to be of an inferior description, or

	24-pdr.		12-pdr.		Total.
Diaphragm..........	6	..	5	..	11
Spherical Case Shot..	2	..	6	..	8
Improved............	3	..	3	..	6

faulty construction (probably those referred to by Captain Boxer, as made by Contractors before the casting was undertaken by Government) for the defect above adverted to appears to have been anticipated, and attempted to be met by plastering the edges of the diaphragm with some composition similar to Kitt, or Cobbler's wax, which has however not answered the purpose perfectly, being always found in a half melted state when picked up after the explosion of the shell. Probably the after castings of the Government Factory may have been more successful and so rendered this plastering process needless.

IX. The improved Shrapnell Shells were merely the common Spherical Case Shot with a tin cylinder vertically fixed in prolongation of the brass socket (which receives the fuze), to which it is united by solder and through a small hole at the bottom of which it is filled with the bursting powder.

X. The shell having been filled with balls has melted resin poured in, which, on hardening, presents a solid mass, so preventing injury to the tin cylinder, as well as the cohesion of the balls during flight or on concussion, which is so great that they are often (in a recovered unburst Spherical Case Shot) found in one mass,—sometimes, however, the balls struck the target in large masses, the marks distinctly indicating that the indentations were caused by lumps of unseparated resin and balls; in one instance, a mass of this kind went clean through the target.

The practice with this shell is much the same as with the ordinary Spherical Case Shot. The balls were observed, however, to spread too much, but they hit harder than the diaphragm balls, although not with the same force as the Spherical Case Shot in use with the Madras Artillery.

No particular irregularity or deflection was observed in these altered shells, and the number of failures was less than in either of the other cases. In firing this shell from a state of rest, whether on the ground or on the tripod, the fuze horizontally or vertically fixed, the result was the same, and as might be anticipated—a very wide scattering of the balls and splinters in all directions—in the open air as far as from 80 to 100 yards—but in the wooden enclosure none of the balls of any of the shells appeared to have force enough to go through the planks; though the improved Shrapnell Shell made indentations of nearly ¼ of an inch, which, considering the comparatively very small charge* of bursting powder, as well as the solid mass it has to penetrate and loosen before it can reach the crust of the shell, would indicate this as the most favorable position for the development of the greatest explosive force, although, theoretically any surplus force within the shell is a disadvantage in Shrapnell practice—no greater being sought for than just sufficient to release the balls, and leave the impetus already communicated as little disturbed as possible. From subsequent trials it was found, that half the present bursting charge is sufficient to open the shell, and even this scatters the balls a good deal.

XI. Nothing remarkable was noticed with the ordinary Spherical Case Shot practice. On comparison with the other two shells, this projectile was on the whole unquestionably the most effective. The reason may be found in the advantage of momentum given by the 30 additional Musket balls in the 24-pounder Howitzer, and of 63 *Musket* balls in the 12-pounder against 66 *Carbine* balls when compared with the Diaphragm Shell,—besides in the former case, double the bursting charge and the powder disposed in a more favorable manner.

XII. Comparing the "ordinary" with the "improved shell," the proportion of balls is as 130 to 115 in the 24-

		ozs.	drs.
* 24-Pounder	Diaphragm Shell........	3 ..	0
12 "	" "	1 ..	12
24 "	Spherical Case Shot......	6 ..	0
12 "	" " "	4 ..	8
24 "	Improved Shrapnell Shell.	1 ..	9½
12 "	" " " ..	1 ..	0½

pounder Howitzer and 63 Musket balls to 76 Carbine in the 12-pounder Howitzer, with more than four times the amount of bursting powder in the one than the other. In the course of the practice, the following experiments were made with reference to Captain Boxer's observations in his Memo. dated 8th February 1858, and their results confirm that Officer's statements.

XIII. Two 24-pounder Spherical Case Shot were prepared with 130 Musket balls and 6 ounces of bursting powder,—a wooden plug being firmly driven into the fuze hole of each.

XIV. The first was fired into the Butt from a 24-pounder Howitzer with service charge about 60 yards distance, and burst immediately on *striking the Butt* which it penetrated about a foot, the splinters of the shell and balls remaining near where the shell exploded,—nearly the whole of the balls, the splinters, and the plug entire were recovered, many of the leaden balls considerably mishapen and smashed by the concussion, but none adhering together as has often been observed in Spherical case practice. The second burst on the Howitzer being fired, scattering the splinters and balls forward in all directions.

XV. It having been suggested that common shells being stronger than Shrapnell, it would be interesting to see if corresponding results would be produced under similar conditions,—

XVI. Two 24-pounder *common shells* were prepared, one containing 80 Madras leaden musket balls and 6 ounces of bursting powder,—the other 77 English musket balls (taken from a Diaphragm Shell) and 6 ounces of bursting powder, with a wooden plug firmly driven into the fuze hole of each. The first on being fired into the Butt from a 24-pounder Howitzer at a distance of about 50 yards, struck against some hard substance, which broke the shell, reducing part of the powder to a very fine grain, and forming the remainder into a hard cake. The balls were mis-shapen but did not adhere together.

XVII. The other shell did not burst and was recovered. On examination the powder was found slightly caked, and many of the balls slightly indented.

XVIII. On a suggestion that the disadvantage of the old Spherical Case in travelling, was not so much the risk of explosion from the powder being mealed by constant friction, as its loss of explosive force in that condition,—

XIX. A 24-pounder ordinary Spherical Case Shot containing 130 musket balls and 6 ounces of *mealed,* instead of *fine grained* powder, was fired on the ground in a state of rest, fuze uppermost. On exploding, the balls and splinters were scattered in all directions to a distance of nearly 100 yards.

(Signed) G. **Briggs**, Major,
Acting Director Artillery Depôt.

(,,) P. **Hamond**, Brigadier,
Commandant of Artillery.

Artillery Head Quarters,
St. Thomas' Mount,
25th September 1858.

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Experiments carried on at Saint Thomas' Mount, with three Experimental Mortars received from Calcutta, in conformity with Military Board's Extract of Proceedings No. 5081 dated 11th December 1856—with Plate 9.

Letter from the Brigadier Commandant of Artillery to the Military Board, No, 55 dated 11*th February* 1857.

The Experimental Practice having been completed, which was ordered (in Board's Extract of Proceedings No. 3,862 dated 22d October 1856,*) with a view to test the merits of the 5½ inch Experimental (Conical Chamber) Mortar, (of 4 *inches* greater length than the Bengal (Gomer) short Mortar, and 2 *inches* longer than the Established Pattern (Conical Chamber) Madras Mortar, I have the honor to forward, herewith, a report of the Practice with a Memorandum,* briefly reviewing the origin and progress of the investigation made during the last three years, in order to ascertain the merits of this class of Mortar; and I request you will lay the above Papers before the Board for consideration, and for such further steps as may be deemed expedient.

MEMORANDUM.

1. The Established 5½ inch Mortar in use with the Madras Artillery for a great many years past, and never abolished or superseded up to the present time, is in construction as per margin (*a.*)

(*a*) Conical Chamber.	Ft.	In.	Pts.
Length of Bore including Chamber	1	1	9
Diameter of Bore	Inches 5·63		
Chamber	Conical		

2. In March 1853, six 5½ inch Mortars were supplied from the Bengal Foundry, differing from the Madras Mortar in form of chamber, and in measurements; as the dimensions in the margin will shew (*b.*)

(*b*) Gomer Chamber.	Ft.	In.	Pts.
Length of Bore including Chamber	0	11	9
Diameter of Bore	Inches 5·66		
Chamber	Gomer		

3. Experimental Practice was held to determine the value of the new, or Bengal Mortar, on its own merits; as well as in comparison with the established Mortar previously in use at Madras.

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* And Drawings of Mortars used.

* And No. 5081 dated 11th December 1856.

4. A Madras conical chambered Mortar, also, was reamed out into a Gomer Chamber, to test the difference between it and the new Bengal Gomer; there being 2 inches difference in length of Piece, and ·03 inch diameter of Bore, in favor of the Madras Mortar.

5. The results of this experimental Practice, with plans and dimensions of the several Pieces, and *with differences in windage specially adverted to,* are given in the Proceedings of the Madras Artillery Select Committee, Meeting 182 Article 672, 16th September 1853, pages 355, 363, Madras Artillery Records.

6. The opinion of the Madras Committee, formed on these results, condemned the new Bengal Mortar, as inferior in its performance not only to the established Madras Mortar, but also to the same Mortar when reamed out into a chamber similar to that of the new Bengal Mortar (Gomer); and imputed this inferiority to the shape of chamber, and the reduced length of Bore. (Vide Remarks attached to Madras Experiments in September 1853, and February 1856.)

7. An experimental (Gomer chamber) Mortar, 2 inches longer than the Madras established Mortar, and 4 inches longer than the new Bengal (Gomer) Mortar, was subsequently supplied from Bengal, in accordance with the views of the Madras Military Board, founded on the opinion of the Artillery Select Committee. This Mortar was tested in comparison with the Madras (Conical chamber) established Mortar, in September 1854, and the results are published in the Madras Artillery Records "Practice and Experiments" page 20 of 1854; the object of the experiment being to determine the relative value of *their respective Chambers* at 45°, with charges giving nearly similar Ranges.

8. It was also tested in comparison with the three other Mortars, viz. 1st.—Madras Conical, 2nd.—Bengal short Gomer, 3rd.—Madras reamed up Gomer,—with a view to ascer- the effect of length of Bore on ranges; and the results of this Practice (given at pages 21 and 22 Madras Artillery Records,

" Practice and Experiments," 1854 and 1855,) exhibit most conclusively, the value due to increased length of Bore, in the uniformly progressive length of range, with all charges and elevations, from the shortest to the longest Gomers. These ranges were headed throughout, (and increasingly with augmented charges) by the old established Madras (Conical chamber) Mortar.

9. An experimental (Conical chamber) Mortar, with 3 inches increase of length, was then cast at the Madras Gun Carriage Manufactory, and tried in comparison with the old established Madras Mortar, the results appearing in pages 23-29 of Madras Artillery Records, " Practice and Experiments" of 1856,; but in this instance, increased windage and size of chamber diminished the power of the Piece, and disappointed the expectations formed of this experimental Mortar.

10. Mortars were then applied for and furnished from Bengal, of the old Conical chamber construction, but with 4 inches additional length; the Bore, however, corresponding with that of the Bengal (Gomer) Mortar 5·66 inches, instead of with that of the old Madras (Conical) Mortar, 5·63 inches. A Bengal (Gomer) Mortar, also of 5·66 inches bore, was received at the same time, and a comparative Practice carried on, with various charges, and at various elevations, as exhibited in the accompanying report, under the following conditions: viz. 1st.—The shells were all of similar gauge for the Mortars of similar Bores, thus equalizing windage. 2nd.—The weights of the shells vary unavoidably; but the expedient to raise them to one uniform standard, by putting in sand or lead, being liable to objections of more consequence then the variation of weight, was not adopted. 3d.—The proportion of windage was as exact as the shells which could be obtained, allowed; the windage for the established Pattern of Madras (Conical) and Bengal (Gomer) being ·06, inch, and for the experimental long (Conical) ·05 inch.

11. An examination of the general results of the experiments above briefly noticed, seems to establish,

1st.—That with equal charges, the Mortar with Conical chamber gives far greater ranges than the Mortar with Gomer chamber; without such inferiority in uniformity of range, as to justify the abandonment of a powerful Piece for a very feeble one.

2nd.—That increased length of Bore, other conditions being the same, invariably improves range, and steadiness of Practice.

12. An Article appears in Volume V of the published Index to the Proceedings of the Bengal Artillery Select Committee on this subject, wherein there seems to be some misapprehension on certain points. The established pattern Mortar is assumed, (in paras. 2, and the last but one) to be the short Gomer chamber Mortar introduced or received at Madras in 1852, (it would seem) of 5·66 inches Bore; whereas, in the Madras Artillery, (and we believe also in the Bengal Artillery) no authority has been promulgated for any deviation from the admirable Conical chambered Mortar of 5·63 (or 5·62) inches, in use at Madras for a long period of years, and also it is believed, with the other Artilleries of India, and never abolished or superseded.

13. The results of Practice carried on at Madras, on which the unfavorable opinion of the Bengal short (Gomer chamber) Mortar has been formed, are all published, with professional deductions, in the Madras Artillery Records, and speak for themselves; but when the accuracy of that opinion is questioned (as in the 11th para. of the Bengal Proceedings) on the ground that an admitted excess of more than ¼th the extent of range with equal charges and elevations, (822 yards. to 600 yards.) is "*a very small difference*," the prospect of any unity of views seems distant. There is a further misconception also in the concluding para. of the Proceedings of the Bengal Committee viz. that the experimental long Mortar with Gomer chamber "has been condemned at Madras." But that is not the case: the Practice with it entirely justified the reasoning on which the application for it was found-

ed, this Mortar exhibiting all the superiority anticipated from its increased length, over the short Gomer Mortar (windage being the same,) and also over the reamed out Madras (Gomer) Mortar, but nevertheless falling short of the old established Madras Mortar *(Conical Chamber)*. On this same reasoning, still greater power has been sought and obtained, in the last *(Conical chamber)* experimental Mortar sent from Calcutta, *with 4 inches increased length*; but the *full* advantages of this Mortar, have been injuriously influenced, by the bore being 5·66, instead of 5·63 inches; which latter diameter would have made it an almost perfect 5½ inch Mortar.

14. It now appears a question worthy of consideration, whether under the operation of the recent order of the Governor General (communicated in Minutes of Consultation of Government No. 3,379 dated 23d December 1856,) establishing intercommunication between the Select Committees of the three Artilleries, an improved 5½ inch Mortar, combining the advantages of minimised windage and increased length, with that form of chamber (Conical), which with small charges is most favorable to the action of the Powder, both with reference to the density and temperature of the gases generated, might not be established for the Indian Artilleries.

15. And this it is confidently expected will be fully realized in a Mortar of exactly similar chamber and diameter of Bore (5·63 inches) to the old established 5½ inch Conical chamber Mortar, but with 4 inches increased length of Bore, and diminished thickness of metal, so as to preserve the most effective form of this chamber, improved by length of Bore: the weight of this Mortar exceeding but little, if at all, that of the original Mortar, viz. 184. lbs.

(Signed) G. ROWLANDSON, Major,
Director Artillery Depôt.
(Signed) ÆNEAS SHIRREFF, Brigadier,
Commandant of Artillery.

ARTILLERY DEPÔT:
Saint Thomas' Mount,
11*th February* 1857.

Table shewing the dimensions, weight, &c. of three Experimental Brass 5½ Inch Mortars received from Calcutta.

Description of Mortar.	Marks on the Piece.	Weight.			Length							Breadth between the outer extremities of the Trunnions.			Diameter											Chamber.							Shape.	Total length of Bore and Chamber.			Distance from the shell when placed in the Mortar to the muzzle of the Piece.	
					of the Piece.			of Trunnions,							at the Trunnions from shoulder to shoulder.			of Trunnions.				of Bore.				Diameter of				Length.							
								Right.		Left.								Right.		Left.		Horizontal.		Vertical.		Superior.		Inferior.									
		cwts.	qrs.	lbs.	ft.	ins.	pts.	ins.	pts.	ins.	pts.	ft.	ins.	pts.	ft.	ins.	pts.	ins.	pts.	ins.	pts.	ins.	pts.	ins.	pts.	ins.	pts.	ins.	pts.	ins.	pts.		ft.	ins.	pts.	ins.	pts.
Mortar Brass Experimental long 5½ Inch.	A. Broome, Cossipore. 1856, No. 3.	1	3	8	1	9	..	3	50	3	50	1	3	..	..	8	0	2	80	2	80	5	66	5	66	3	..	2	25	5	80	Conical.	1	5	9	7	..
Mortar Brass Bengal Short 5½ Inch.	A. Broome, Cossipore 1854, No. 42,	1	1	10	1	3	..	3	30	3	30	1	3	..	..	8	40	2	80	2	80	5	66	5	66	5	66	2	9	6	2	Gomer.	..	11	9	3	.05
Mortar Brass Madras pattern 5½ Inch.	A. Broome, Cossipore, 1856, No. 1.	1	2	16	1	5	..	3	30	3	30	1	3	..	..	8	40	2	80	2	80	5	63	5	63	3	..	2	25	5	80	Conical.	1	1	9	2	·45

Table shewing *r, the Bengal Brass Mortar short 5½ Inch Gomer*
Chamber, *ilitary Board's Extract of Proceedings* No. 5081
dated 11*th*

s.

ds.

Date.	Elevation.	Charge,	Brass Madras Pattern 5½ Inch Conical Chamber.											
			Diameter.		Windage.	Flight.		Range.			Deflection.		Recoil.	
								Real.	Medium.	Greatest difference.	Right.	Left.		
	degs.	ozs.	ins.	pts.	pts.	sec.	pts.	yards.	yards.	yards.	yards.	yards.	feet.	ins.
29th December 1856.	15	2	5	58	·05	2	30	*116	118	4	..	4		
		,,	5	58	·05	2	30	118			..	6		
		,,	5	58	·05	2	30	*120			..	6		
		,,	5	58	·05	2	30	117			..	6		
		,,	5	58	·05	2	30	118			..	7		
		3	5	58	·05	3	30	*197	206	9	..	9	not taken	
		,,	5	58	·05	3	30	206			..	3		
		,,	5	58	·05	3	30	*205			..	4		
		,,	5	58	·05	3	30	206			..	2		
		,,	5	58	·05	3	30	206			1	..		
		4	5	58	·05	4	15	329	333	82	6	..		
		,,	5	58	·05	4	30	343			..	9		
		,,	5	58	·05	4	30	*359			..	7		
		,,	5	58	·05	4	15	327			..	4		
		,,	5	58	·05	5	..	*409			..	3	2	6
		5	5	58	·05	5	..	500	502	126	8	..	3	3
		,,	5	58	·05	5	..	510			10	..	4	..
		,,	5	58	·05	5	..	497			..	7	4	..
		,,	5	58	·05	5	..	*463			..	4	3	10
		,,	5	58	·05	4	30	*384			..	4	3	3
30th December 1856.		6	5	58	·05	5	15	594	616	114	..	12	4	..
		,,	5	58	·05	5	30	*672			..	20	4	..
		,,	5	58	·05	5	15	594			..	24	4	..
		,,	5	58	·05	5	30	659			..	16	4	..
		,,	5	58	·05	6	..	*708			..	55	4	..
		8	5	58	·05	6	30	*878	993	214	..	49	6	..
		,,	5	58	·05	7	..	976			..	29	6	3
		,,	5	58	·05	7	..	974			..	79	6	..
		,,	5	58	·05	9	..	*1092			26	..	6	..
		,,	5	58	·05	8	15	1028			..	12	6	3
		10	5	58	·05	9	15	1298	1199	482	40	..	9	6
		,,	5	58	·05	10	15	*1340			..	56	8	..
		,,	5	58	·05	10	..	1249			..	69	10	3
		,,	5	58	·05	11	..	*1531			..	90	10	3
		,,	5	58	·05	9	..	1049			45	..	8	..

merChamber.

	Deflection. Right. yards.	Deflection. Left. yards.	Recoil. feet.	Recoil. ins.
	..	4	..	2
	..	3	..	2
31	..	1	..	3
	..	4	..	3
	..	1	..	3
	..	6	..	4
	..	7	..	5
59	..	9	..	6
	..	5	..	6
	line		..	6
	..	16	1	..
	..	4	1	..
51	10	..	1	1
	..	6	1	1
	4	..	1	1
	16	..	1	10
	..	4	1	9
91	..	5	1	9
	..	6	1	10
	..	7	1	10
	30	..	3	..
	..	70	3	2
54	..	24	3	2
	..	3	3	2
	56	..	3	..
	..	2	..	3
	..	1	..	3
27	4	..	..	3
	4	..	..	3
	4	..	..	3
	10	..	..	4
	4	..	..	5
52	..	1	..	5
	4	..	..	7
	..	17	..	9
	..	3	..	10
	..	4	..	10
69	10	..	1	..
	..	21	1	..
	4	..	1	..
	..	16	1	6
	..	38	1	4
56	..	41	1	9
	29	..	1	6
	..	66	1	6
	..	39	2	10
	20	..	2	6
70	..	32	2	10
	..	61	2	9
	38	..	2	10

Mortar Brass Madras pattern 5½ Inch Conical Chamber.

Shell. Number.	Shell. Weight. lbs.	Shell. Weight. ozs.	Shell. Weight. drs.	Shell. Diameter. ins.	Shell. Diameter. pts.	Windage. pts.	Flight. sec.	Flight. pts.	Range. Real. yards	Range. Medium. yards.	Range. Greatest difference. yards.	Deflection. Right. yards.	Deflection. Left. yards.	Recoil. feet.	Recoil. ins.
2	16	2	8	5	58	·05	3	30	*142			..	7	..	3
3	16	2	12	5	58	·05	4	..	*159			..	5	..	3
4	16	2	12	5	58	·05	4	15	180	178	38	..	7	..	4
5	16	2	4	5	58	·05	4	15	179			..	6	..	6
53	16	2	8	5	58	·05	4	..	174			..	8	..	6
7	16	5	..	5	58	·05	7	..	*506			8	..	1	..
10	16	2	8	5	58	·05	7	..	564			..	48	..	10
13	16	3	..	5	58	·05	7	..	561	573	90	line		1	..
19	16	4	8	5	58	·05	7	15	594			..	16	..	11
20	16	5	..	5	58	·05	7	15	*596			..	14	..	11
22	16	3	..	5	58	·05	11	..	*1107			..	50	1	6
23	16	3	..	5	58	·05	10	..	930			..	30	1	9
28	16	3	12	5	58	·05	10	15	972	961	189	50	..	2	..
29	16	3	8	5	58	·05	10	..	*918			..	30	2	3
31	16	3	12	5	58	·05	10	15	980			..	50	2	3
2	16	2	8	5	58	·05	12	30	*1308			..	20	2	..
3	16	2	12	5	58	·05	12	30	*1340			..	75	3	..
4	16	2	12	5	58	·05	12	..	1202	1234	138	..	60	3	..
5	16	2	4	5	58	·05	12	..	1248			..	58	3	..
53	16	2	8	5	58	·05	12	..	1253			..	65	4	..
7	16	5	..	5	58	·05	14	..	*1502			130	..	6	..
10	16	2	8	5	58	·05	15	..	*1625			35	..	6	..
13	16	3	..	5	58	·05	14	15	1580	1567	123	150	..	6	..
19	16	4	8	5	58	·05	14	15	1568			..	70	5	..
20	16	5	..	5	58	·05	14	15	1554			65	..	5	..
32	16	4	12	5	58	·05	5	..	*168			..	3	..	2
4	16	2	12	5	58	·05	5	15	195			2	..	..	2
3	16	2	12	5	58	·05	5	..	188	190	38	line		..	3
5	16	2	4	5	58	·05	5	..	188			..	2	..	4
53	16	2	8	5	58	·05	5	30	*206			line		..	3
7	16	15	..	5	58	·05	9	..	634			..	2	1	..
10	16	2	8	5	58	·05	10	..	*700			..	10	1	3
13	16	3	..	5	58	·05	9	15	652	640	81	17	..	..	10
19	16	4	8	5	58	·05	9	..	635			28	..	..	11
20	16	5	..	5	58	·05	10	..	*715			..	19	..	11
22	16	3	..	5	58	·05	13	..	*1066			98	..	1	10
23	16	3	..	5	58	·05	13	..	1086			..	66	1	10
29	16	3	12	5	58	·05	12	..	*1002	1090	94	..	7	1	10
28	16	3	8	5	58	·05	12	30	1088			44	..	2	6
31	16	3	12	5	58	·05	12	30	1096			11	..	2	6
32	16	4	12	5	58	·05	17	..	*1577			..	7	3	..
3	16	2	12	5	58	·05	15	..	1344			33	..	2	6
4	16	2	12	5	58	·05	17	..	*1557	1411	233	..	6	1	7
5	16	2	4	5	58	·05	16	..	1450			..	7	2	4
53	16	2	8	5	58	·05	16	..	1440			85	..	2	6
7	16	5	..	5	58	·05	15	..	*1375			..	7	3	..
10	16	2	8	5	58	·05	18	..	1667			20	..	3	..
13	16	3	..	5	58	·05	19	..	*1765	1687	390	..	290	3	..
19	16	4	8	5	58	·05	19	..	1720			75	..	3	..
20	16	5	..	5	58	·05	18	..	1675			56	..	3	..

Exper ass Madras pattern 5½ Inch Conical Chamber.

Date.	Elevation.	Charge.	S				Windage.	Flight.		Range.			Deflection		Recoil.	
			Number.		Diameter.					Real.	Medium.	Greatest difference.	Right.	Left.		
	degs.	ozs.		lbs.	ins.	pts.	pts.	sec.	pts.	yards	yards.	yards.	yards.	yards.	feet.	ins.
5th January 1857.	45	2	14	16	5	58	·05	5	30	185	184	26	..	3	..	2
		,,	21	16	5	58	·05	5	..	177			..	5	..	1½
		,,	24	16	5	58	·05	5	30	190			..	8	..	1
		,,	40	16	5	58	·05	5	..	*164			..	6	..	1
		,,	41	16	5	58	·05	5	..	*177			..	5	..	2
		4	51	15	5	58	·05	11	30	*626	656	34	..	10	..	4
		,,	52	16	5	58	·05	12	..	654			..	3	..	4
		,,	57	16	5	58	·05	12	..	660			..	7	..	4
		,,	59	16	5	58	·05	12	..	653			..	5	..	4
		,,	61	15	5	58	·05	12	..	*642			..	9	..	4
		6	63	15	5	58	·05	17	..	*1147	1081	161	8	..	..	8
		,,	66	16	5	58	·05	16	..	1079			..	30	..	8
		,,	67	16	5	58	·05	16	..	1063			39	..	..	6
		,,	72	15	5	58	·05	15	..	*986			52	..	..	6
		,,	75	16	5	58	·05	16	30	1102			..	65	..	9
		8	14	16	5	58	·05	20	..	1453	1436	120	53	..	1	6½
		,,	21	16	5	58	·05	19	30	1406			226	..	1	4
		,,	24	16	5	58	·05	22	..	*1520			..	197	1	3
		,,	40	16	5	58	·05	19	30	*1400			40	..	1	6
		,,	41	16	5	58	·05	20	..	1448			18	..	1	..

* The e been taken to fix the average

VLANDSON, Major,

Director Artillery Depot.

Artille

Saint Tho

5th Jan

Artillery Head Quarters under instructions from the Military
with 7 charges varying from 2 to 10 ozs. and at Elevations of

35° Elevation.								45° Elevation.								
Experimental long Conical.		Bengal short Gomer.			Madras pattern Conical.			Experimental long Conical.			Bengal short Gomer.			Madras pattern Conical.		
Flight.	Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium, Range.	Medium Flight.		Medium Range.	Medium Flight.		Medium Range.
pts.	yds.	sec.	pts.	yds.	sec.	pts.	yds.	sec.	pts.	yds.	sec.	pts.	yds.	sec.	pts.	yds.
15	257	4	...	122	5	15	190	6	...	216	4	30	121	5	30	184
...	......	...	...	......	...	...	......	...	...	......	...	...	......	...	...	......
30	745	6	...	249	9	15	640	11	...	719	7	...	251	12	...	656
...	......	...	...	......	...	...	......	...	...	......	...	...	......	...	...	......
15	1180	9	30	550	12	30	1090	17	...	1151	10	15	540	16	...	1081
30	1458	11	...	815	15	30	1411	20	...	1542	13	15	837	20	...	1436
15	1744	13	30	1145	18	...	1687	...	...	......	...	...	......	...	...	......

(Signed) G. ROWLANDSON, Major,
Director Artillery Depot.

REFF, Brigadier,
Commandant of Artillery.

Memorandum shewing the Ranges obtained with Shells of 5·61 *inches diameter fired from the Experimental Brass Mortar long* 5½ *inch* (*Conical Chamber*) *on the* 24*th January* 1857.

Elevation.	Charge.		Flight.		RANGE.			DEFLECTION.		REMARKS.
					Real.	Medium.	Greatest difference.	Right.	Left.	
Deg.	Ozs.	Drs.	S.	P.	Yds.	Yds.	Yds.	Yards.	Yards.	
45	4	0	12	0	677			0	9	Only 2 shells of 5·61 Inches could be obtained for this practice, and when measured again at the close, after repeated discharges, they only gave 5·60, thus detracting, in some degree, from the value of the results.
	,,	0	12	0	634	666	53	0	6	
	,,	0	12	0	687			0	7	
	6	0	17	0	1220			0	10	
	,,	0	17	0	1231	1229	11	1	0	
	,,	0	17	0	1228			0	3	

ARTILLERY DEPOT:
SAINT THOMAS' MOUNT,
24th January 1857.

(Signed) G. ROWLANDSON, Major,
Director Artillery Depot.

(Signed) ÆNEAS SHIRREFF, Brigadier,
Commandant of Artillery.

Method to be observed in bursting Iron Guns.

A clear space of ground of not less than 600 yards all round should be selected for operations.

2. No other persons than those engaged on the duty should be allowed within these limits.

3. The Guns should be clean both bore and vent, and so placed on the ground with muzzle raised as to facilitate tamping.

4. The Cartridge bags used may be made of double Dungaree, the prescribed *proof* charges for the several Calibres will be found sufficient whether the Gun be of English or Country casting.

lbs.		Pdr.
18	for	24
15	,,	18
12	,,	12

5. The Cartridge should be gently but firmly rammed home, the Rammer *Head* being a Cylinder flat at the top and sides, tapered towards the shaft, the large end passing freely down the bore.

6. Ram home firmly a dry* wad over the Powder.

7. Now follows the most important part of the work, tamping.—The tamping material may be of sods of grass, clay, broken bricks, mud, gravel, all being well mixed,

---

* Should be "high."

and damped, and put into the Gun in small quantities, every portion being well tamped till the bore is full.

8. The Cartridge should be carefully pricked, and the vent filled with Powder by simply pouring it in, the Pricker is not to be used for the latter purpose, or indeed any metal implement, a cup of damp clay or mud is then formed round the vent capable of holding about an ounce of Powder, and over this a piece of broken chatty with the concave side up and a hole in the centre, through which the Portfire is fastened ; then cover the piece of chatty and the stem of Portfire with damp clay or mud to prevent sparks from the portfire falling on any grains of Powder—half a portfire should be used—all is now ready for firing.

9. Every person should then retire with the exception of the man to light the portfire, this is done by signal, and after lighting the portfire the man must run quickly until he reaches a distance of 6 or 700 yards from the Gun. Any number (9 or 10) Guns may be placed together, and burst at the same time. Excavations might be made at 200 or 300 yards from the Gun for the individual firing to retreat into.

10. When several Guns are to be burst at the same time, the plan is to lay trains of powder from the portfire in each Gun to a central point, igniting the train at that point. The trains can be laid in split bamboos.

11. The firer should be a steady active man with good nerve.

12. There is no danger in this work if coolness and care be observed in execution, but there must be no hurry, no omission of any precautions, no carelessness.

13. Nothing should be left to Native Agency, the Warrant or Non-Commissioned Officer employed must himself see to the careful execution of every point.

11*th November* 1858. } (Signed) G. W. Y. Simpson, Lt.-Col.
Principal Commissary of Ordnance.

Report o r General of Ordnance and Magazines conveyed in
L

Date.	N	Remarks.
April and May 1859.	G	The preparation of Tamping and the method of using it, namely, of putting it into the Gun in small quantities, each portion being well rammed until the bore was filled, is that which was used in the same way with success by Conductor Ward in bursting Guns at Kurnool in 1840 and 1841.
	G	
	G	
	Gu	
	Gu	
	G	
	Gu	
	Gu	(*a*) On these occasions, the object of leaving the vacant spaces in the bore as described was to expose the best lines for fracture which theoretically are at the reinforce rings, to the extreme force of the explosion of the charge, no satisfactory result followed from the arrangement, for the Gun resisted the 8 and 10 lbs. charges, although in one instance not less than 11 shot were used, and it was not destroyed until the established proof charge 12 lbs. with 10 shot were used.

Result.	Remarks
did not burst. did not burst. Burst.	
Burst.	
did not burst. did not burst. Burst.	
Burst.	
did not burst. Burst.	
Burst.	

ocess of preparing metal for casting.

(Signed) B. W. BLACK, Major,
Director Artillery Depot.

PAPERS FROM WOOLWICH,

COMMUNICATED BY

CAPTAIN C. H. HUTCHINSON

MADRAS ARTILLERY,

THROUGH THE

HONORABLE THE COURT OF DIRECTORS,

WITH

Abstracts of Orders, affecting the Ordnance and Ordnance Equipments of the Royal Army; shewing the Additions and Changes in Ordnance, Ammunition, Carriages, Platforms &c. &c. adopted into the Service.

SAINT THOMAS' MOUNT.

Printed by LUCAS D'ROZARIO, at the Artillery Depot Press.

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Papers from Woolwich,

COMMUNICATED BY

Captain C. H. HUTCHINSON,

Madras Artillery,

THROUGH THE

HONORABLE THE COURT OF DIRECTORS.

1856.

I.—FRICTION TUBES.

MEMORANDUM by Captain C. H. HUTCHINSON,

MADRAS ARTILLERY.

The Friction Tube adopted for land service by the Royal Artillery is made of copper; and is composed of three parts.

1. A vent tube containing a hollow priming of mealed powder; from the side of which, near to its upper extremity projects at right angles,

2. A short branch tube called the nib, it is of somewhat larger capacity than the vent tube; and is fashioned to contain

3. A "Friction Piece" the roughed end of which enveloped in a layer of fulminating composition is fixed within the nib in such a manner, that the friction caused by its forcible withdrawal will cause the fulminate, and consequently the priming in the vent tube to explode. The friction piece, is a ring, shaped at its outer extremity to receive a hook attached to a lanyard by which the gun is fired.

The mode of their preparation at the Woolwich Arsenal is as follows.

1. Sheet copper such as used for the manufacture of percussion caps is slit by a machine comprising an arrangement of revolving cutters or circular shears, into strips 0·6 of an inch wide.

2. A boy working with a small fly press, laps up two or three inches of the end of each strip into a cylindrical form.

3. The cylindrical end of a strip is passed through the conical hole of a steel draw-plate and secured in vice like nippers on the drawing machine. Motion is given, and a long thin tube is produced. This being passed through a second and somewhat smaller hole becomes a smooth finished tube of 0·2 of an inch in external diameter. And is carried to

4. A small circular saw; mounted upon a lathe; and with a gauge stop against which the end of the tube under operation is pressed, when it is rapidly cut into lengths of about 3 inches. These form tbe vent or priming tubes.

5. From slips of the same copper, pieces of the form and size shewn in figure *1 are punched in small fly presses worked by boys, and

6. By aid of a grooved forming block and light mallet, each piece is turned round a wire into the form of a tube, from one end of which, in the line of its prolongation, project two narrow strips: see figure *2 This forms the " Nib."

7. The nib is attached to the priming or vent tube by folding round it the two projecting strips of the nib tube and compressing them with a pair of pliers.

8. The attachment is further secured by a few turns of thin copper wire. The tube is held steady during this ope-

Fig 1.

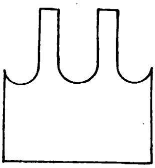


Fig 2.

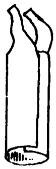
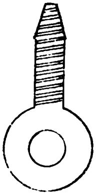


Fig. 3.



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* No Figures accompanied this paper: –

The figures here given, were taken from plate 15 " Selections" published in the July Number of the Artillery Records pages 402 to 405; the Friction Tubes therein described, being similar to those given above.

ration by its end being thrust into a hole bored to receive it in the work table.

9. The two tubes are firmly united by soldering. The point of junction is brushed over with a solution of zinc in spirit of salt, and dipped in plumbers soft solder held in fusion on a soldering iron.

10. A hole is drilled through the axis of the nib into the cavity of the priming tube, and

The tube is now ready for filling.

11. The friction piece figure *3 is punched also from strips of the same copper in a small fly press mounted with three distinct punches, moving together, but performing three successive, though combined operations, viz.

1. Roughing or notching the friction end.
2. Punching the hole to form the ring.
3. Cutting out and detaching the piece in a finished state from the plate.

12. An ounce or two of mealed powder, or powder dust, slightly moistened with spirit of wine is heaped in the corner of a small copper tray ; and into this an end of the priming tube is smartly thrust ; and each successive portion of powder so collected within it, is compressed and consolidated by a brass rammer or drift, tapped two or three times lightly on the work table.

The drift has a pin projecting in the line of its axis and is fitted to a small wooden handle. The tube being filled, a small pricker is run through the powder to ensure a central cavity throughout.

A man can fill thirty, in an hour.

13.

Chloride of potass............	6 oz.
Antimony.....................	6 oz.
Sublimed sulphur...........	½ oz.

is sifted through a wire sieve having 80 meshes to an inch, and cautiously mixed by giving motion to sheets of paper on which it is spread. No rough treatment could be adopted without danger of explosion.

14. Slightly moistened with shell-lac and naptha-varnish to give it some little cohesion, the above composition is lightly pressed by a thin wooden spatula into rectangular holes pierced through a thin plate of brass resting upon a sheet of glass, and then removed by means of a brass punch, in the form of brittle cakes 0·4 inch long, 0·1 inch wide, and 0·25 inch thick.

15. The notched end of a friction piece has its extreme point reflexed, and is then introduced with the turned overpart of its point upwards, into the nib of a tube. A cake of fulminate is inserted above and another below it; and the pliers are then used to flatten the copper nib tube so as to compress the fulminate upon the friction piece: the upper side of the nib tube is at the same time shaped with a step, to catch the turned over point of the friction piece and prevent its withdrawal, unless somewhat forcibly acted upon. The ring end is bent up to allow of the lanyard being more readily hooked on.

A man can do 27 in an hour.

In these manipulations caution is necessary to avoid a rubbing or sliding motion of the parts which would probably cause an explosion.

16. Thin, tough paper is punched a quire at a time, into disks $\frac{5}{8}$ths of an inch in diameter.

17. A paper disk is pasted over each end of the vent tube. A little alum is mixed with the paste.

18. Varnish composed of lampblack, shell lac, and naptha is brushed round the lips of the nib tube where the friction piece enters it to exclude moisture.

19. The whole tube is, lastly enveloped in a thick coat of black paint and being allowed to dry is now complete and ready to be issued for service.

II.—Small Arms of the British Service 1856. (G. F.) T. P. W.

1 PERCUSSION MUSKET, PATTERN, 1842.

This is the smooth bore musket introduced into the service in the year 1842, and may now be considered obsolete for British Infantry; its effective range is 200 yards, Barrel—length 3 feet, 3 inches; diameter of bore ·753 inch; Musket length 4 feet, 7 inches; weight 10 lbs. 2 ozs. Bayonet length (beyond muzzle) 1 foot 5½ inches; weight, 1 lb. 1 oz. Arm complete with bayonet—length 6 feet, ½ inch; weight 11 lbs. 3 ozs.

Ammunition—bullet (Spherical) 490 grs. or 14½ to the lb. charge 4½ drams F. G. weight of 60 rounds, with 75 caps, about 6 lbs. 10 ozs., is packed in barrels or boxes containing 500 rounds each, with 625 caps and weighing about 55 lbs.

Penetration at 50 yards 8—½ inch elm boards 1 inch apart.

---

2 RIFLE MUSKET 1842.

Several of the muskets of this pattern already described, have been rifled with 3 and 4 grooves and sighted to 1000 yards. They are issued to the Marines, and the same rifle shortened, and same description of ammunition to the Navy. Description (For dimensions &c. See 1,) Rifling grooves 3 and 4; Spiral, 1 turn in 6 feet 6 inches. Ammunition—an elongated bullet, weight with iron cup, 848 grs.; diameter ·745 to ·746. Charge 3 drs. F. G. Weight of 60 rounds with caps about 8 lbs. 9 ozs.—Packed for store in quarter barrels, containing 500 each, with 625 caps and weighs 79 lbs.

Penetration—at 50 yards 11—½ inch elm boards 1 inch apart.

---

3 MUSKET RIFLED SEA SERVICE, 1842.

This is the old percussion musket of 1842, shortened and rifled for the Navy. Barrel length 2 feet, 6 inches; diameter of bore, ·753 inch. Rifling grooves 3; Spiral, 1 turn in 6 feet, 6 inches. Musket length 3 feet 10 inches, weight 9 lbs, 4¾ ozs.

Bayonet length beyond muzzle 1 foot 6 inches, weight 1 lb. 1¾ oz. Arm complete with bayonet length 5 feet 3½ inches; weight 10 lbs. 6 ozs.

Ammunition same as for No. 2.

4 RIFLE MUSKET PATTERN, 1851.

This was the first rifle musket with elongated bullet introduced into the service, issued in 1851, it was the general arm in use with the British Infantry at the early part of the present war, is now superseded by the Enfield, is sighted to 900 yards. Rifle barrel length 3 feet 3 inches; diameter of bore ·702 inches. Rifling grooves 4; Spiral, 1 turn in 6 feet 6 inches; Musket length 4 feet 7 inches; weight 9 lbs. 9¼ ozs. Bayonet length beyond muzzle 1 foot 5½ inches; weight 15½ ozs. Arm complete with bayonet length 6 feet 0½ inch; weight 10 lbs. 8¾ ozs. Ammunition—an elongated bullet; weight with iron cup 696 grs. diameter ·690 to ·691 inch. Charge 2½ drs. F. G., weight of 60 rounds with 75 caps about 7 lbs. The ammunition is packed in quarter barrels or boxes 500 rounds in each with 625 caps; a box weighs about 66¼ lbs.: a barrel about 65¼ lbs.

Penetration—at 50 yards 10—½ inch elm boards placed 1 inch apart.

5 ENFIELD RIFLE MUSKET PATTERN, 1853.

This rifle was adopted for the service in the year 1853, after experiments carried on at the Royal Manufactory, Enfield Lock in 1852, and may now be considered the approved universal arm in use by the British Infantry.—It is sighted up to 900 yards, but its practice is good at a longer range.

Barrel length, 3 feet 3 inches; diameter of bore ·577 inch or 24 bore. Rifling grooves 3; Spiral, 1 turn in 6 feet 6 inches; Musket length 4 feet 7 inches; weight 8 lbs. 8 ozs. Bayonet length beyond muzzle, 1 foot 5½ inches; weight 11 ozs. Arm complete with bayonet length 6 feet 0½ inch; weight 9lbs. 3 ozs.

Ammunition—an elongated ball with iron cup or wood plug (the latter making the best shooting); weight with cup or box-wood plug 530 grs.; diameter ·567 to ·568, (introduced in June 1855, in place of the Pritchett bullet without expanding agent), charge 2½ drs. F. G.; weight of 60 rounds with 75 caps about 5 lbs. 8 ozs.

The ammunition is packed in quarter barrels or boxes, with the proportion of caps; a quarter barrel containing 700 rounds with 875 caps, and weighing about 73½ lbs. the box containing 560 rounds with 700 caps weighing about 60½ lbs.

Penetration at 50 yards 11—½ inch elm boards placed 1 inch apart.

The swell of the rammer is done away with; the rammer generally stouter throughout and held in the stock by means of a roller and spring, obviating the necessity of the swell being forced under the top band.

ARTILLERY CARBINE, PATTERN 1853.

This carbine was adopted for the Artillery about the same time as the Enfield Rifle Musket by the army. Its practice is good to 1000 yards, but it is only sighted to 300. Barrel length 2 feet; diameter of bore ·577 inch. Rifling grooves 3; Spiral, 1 turn in 6 feet 6 inches. Carbine length 3 feet 4½ inches; weight 6 lbs. 7½ ozs. Sword bayonet, (beyond muzzle) 1 foot 10¾ inches; weight 1 lbs. 12 ozs. Arm complete with sword bayonet, length 5 feet 3 inches. Weight 8 lbs. 3¼ ozs.

Ammunition—Bullet—iron cup or wood plug ball, same as Enfield Rifle, charge 2 drs. F. G. Weight of 20 rounds of service ammunition with 25 caps, about 1 lb. 13 ozs. Packed in quarter barrels or boxes—the barrel containing 800 rounds and 1000 caps, and weighing about 81½ lbs.; the box containing 600 rounds, 750 caps and weighing about 63 lbs.

Penetration—9—½ inch elm boards placed 1 inch apart.

SHORT RIFLE FOR RIFLE CORPS.

Barrel length 2 feet 9 inches; diameter of bore ·577 inch. Rifling grooves 3; Spiral 1 turn in 6 feet 6 inches.

Musket length 4 feet 0⅝ inch, weight 8 lbs. 2 ozs. Sword bayonet length beyond muzzle 1 foot 10½ inches. Weight 1 lb. 9¾ ozs. Arm complete with sword bayonet length 5 feet 11¼ inches. Weight 9 lbs. 11¾ ozs. Ammunition same as Enfield Rifle 1853.

GENERAL INSTRUCTIONS FOR LOADING RIFLES OF ALL DESCRIPTIONS USED IN THE SERVICE.

To load:*—Bite off the piece of twisted paper covering the cylinder containing the powder; pour it into the barrel, reverse the ball, and enter it into the barrel about two-thirds, or to the depth of cylindrical part of ball; a sharp jerk will then tear off the paper to be thrown away; the ramrod in ramming down should be used as lightly as possible, only sufficient force being exerted to press the bullet home, or the head of it will be defaced and the deflection thereby increased.

The following method for removing fouling was discovered and has been practiced by the Royal Laboratory Department; it has been found very successful.

When any difficulty is found in ramming down the bullet, proceed to load the next round in the usual manner, but instead of tearing off the paper when the bullet is inserted in the mouth of the piece, ram the whole of the paper down with the bullet. Fire this, and if the fouling be not entirely removed, load again in the same manner; two rounds will generally be found sufficient.

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* The method for some time practiced in the Royal Laboratory is to hold the cartridge in the right hand, and tear off the paper with the forefinger and thumb of the left hand, which is grasping the rifle at the same time, this has been done during the most severe weather.

It is desirable that this plan be adopted before the rifle gets very foul, or difficulty will be found in ramming down.

It was found that of 10 rounds loaded in this manner, 5 bullets struck a 12 feet square target at a range of 500 yards: the other 5 missed, thus proving that the shot with paper is not altogether useless.

The rifle-man must not be discouraged, should fouling take place, after a few rounds even, on some occasions with the best ammunition it will occur in hot, dry, weather. Care should be taken when at practice that the range is quite clear, as with any ammunition an occasional strip* may occur, the bullet may then at an elevation for 500 yards, graze at 100 yards from the marksman, and the deflection after grazing owing to the shape of the bullet be very great.

To CLEAN THE RIFLE.—Wash out well; dry thoroughly; and then pass a slightly oiled rag down the barrel.

After many rounds say 2 or 300 from the same rifle, a very hard deposit (sulphide of potassium) will in nearly all cases be found to have been left by the powder, at the breech, to remove which more care is required, the water used in cleansing must remain a longer time in contact with it than on an ordinary washing out. Warm water will remove it at once.

The pistols commonly in use in the British service at the present time are Revolvers, known as Colt's, and Deane and Adam's. A great part of the Cavalry and of the Land Transport Corps are armed with Revolvers of one or the other of the kinds. Colt's have also been issued to the Navy.

DIRECTIONS FOR LOADING COLT'S REVOLVING PISTOLS WITH ELEY'S CARTRIDGES.

Fire a cap on each nipple to clear them. Hold the pistol at half cock, muzzle up, in the left hand, tear the covering off the cartridge by pulling the piece of tape attached to it. Place the cartridge without breaking the metallic cover, or blue paper, whichever it may be, containing the powder in the chamber. Turn the chamber containing the cartridge under the ramrod or lever, and force the bullet below the mouth of the chamber, place another cartridge in the next chamber, withdraw the lever from the chamber, and proceed as before until the whole are charged, place a cap upon each nipple, pressing them well home.

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* Strip—When the ball does not follow the grooves but tears through them.

Take care on each cocking between the discharges, to hold the muzzle down, or the revolver may be fouled by the exploded caps, and great care to be taken to remove every appearance of oil from the chamber and nipples before loading.

CLEANING.

You must set the lock at half cock ; then drive out the key that holds the barrel and cylinder to the lock frame, they can then be removed ; should the barrel stick on the pin, the lever may be used to aid in removing it, by forcing the rammer on the partition between the chambers. Wash the cylinder and barrel in warm water, dry and oil them thoroughly, oil freely the base pin on which the cylinder revolves.

TO TAKE THE LOCK TO PIECES, CLEAN AND OIL.

1. Remove the stock, by turning out the bottom and two rear screws that fasten it to the guard and lock frame.

2. Loosen the screw that fastens the main spring to the trigger-guard, and turn the spring from under the tumbler of the hammer.

3. Remove the trigger-guard, by turning out the three screws that fasten it to the lock frame.

4. Turn out the screw and remove the double spring that bears upon the trigger and bolt.

5. Turn out the screw pins that hold the trigger and bolt in their places.

6. Turn out the remaining side screw pin, and remove the hammer with hand attached, by drawing it downwards out of the lock frame. Clean all the parts and oil them thoroughly.

To put them together.—Replace the hammer with hand attached, then the bolt, the trigger, the trigger-guard, the main spring, and finally the handle, returning each of the screws in their proper places, the arm is again fit for use.

III.—FUZES.

Memo. on Shells and Fuzes.

Shrapnells.

The frequent failures that had previously taken place in firing shrapnell shells at home and abroad, led to a series of Experiments in 1852 at Shoeburyness. The principal points to be determined by these Experiments, as stated in the Programme were.

1st. The causes of premature explosions.
2d. The causes of the shells not bursting.
3d. The remedies to be applied.

The guns used were the following.

Iron.	Brass.
8 Inch Gun.	12 Pdr. Gun.
32 Pdr. ,,	9 Pdr. ,,
24 Pdr. ,,	6 Pdr. ,,
8 Inch Howitzer.	32 Pdr. Howitzer.
	24 Pdr. ,,
	12 Pdr. ,,

The fuzes were.

Old fuzes with old priming.
Old fuzes with new priming ; and
New fuzes.

The shells were also of various patterns viz. those with fuze holes having the smooth lip, the screw lip, and the fuze hole without projecting lip.

The results were as follows,

511 good.
108 blind.
37 burst at muzzle.
656

The blind shells were nearly all recovered.

The priming of the fuzes was burnt, but the fuze composition had not ignited.

The quickmatch of the fuze was then fastened, at the Royal Laboratory, more securely, so that it should not be blown away. *There was still one blind shell out of six from the same cause.*

Thirty shells were then fired with fuzes primed according to Captain Boxer's method, and all *were good.*

The practice was repeated in 1853 with fuzes prepared,

1st. By passing the point of a brass pricker through the priming and scraping the surface of the fuze composition.

2d. With fuzes primed according to Captain Boxer's method, i. e. by boring a hole through the priming and $\frac{2}{10}$ths of an inch into the fuze composition.

The first method did not succeed, the second succeeded most satisfactorily. The premature bursts were more frequent than in 1852.

The shells were fired generally in the state in which they were issued at Woolwich, without having been emptied and cleaned at Shoeburyness, as was done in 1852.

For the bursts at the muzzle, various causes were assigned, and although in some instances they appeared to proceed from a defective shell, an irregular fuze hole, or a bad fuze, no satisfactory conclusion could be formed.

Smaller charges were tried, and as might be expected, with somewhat improved results; still it was left uncertain, whether the evil was caused by the uneven thickness or other defects of the shell, or by the ignition of the bursting powder from the friction of the balls within the shell.

General Shrapnel, many years ago arrived at this latter conclusion, viz. that the ignition of the bursting powder was sometimes caused by the reaction of the balls on the inside of the shell.

He found that powder placed in the hollow of a broken 8 inch shell, could be ignited by a lead ball fired from a musket at a distance of 30 or 40 yards, and that the same effect was produced when the broken shell was lined with lead $\frac{1}{2}$, or $\frac{3}{4}$ of an inch in thickness.

But it does not appear that General Shrapnel used any means to separate the powder from the balls, except by driving the latter tight, and then removing a few near the fuze hole to make a space for the bursting powder.

This reduced the number of bursts at the muzzle.

BOXER'S SHRAPNEL SHELLS AND FUZES.

Captain Boxer's fuzes not being adapted to the shells of the Service, none were tried in the foregoing experiments, but the reaction of the musket balls in the shell, having been considered likely to loosen or drive out the fuze on the discharge of the gun, especially from shells without any projecting lip, and thus be one cause of premature explosions, some shrapnel shells were made with a deep lip in 1852 according to a pattern furnished by Captain Boxer, and adapted to his fuze, which was thus protected from liability to accidents of this kind.

The practice with Captain Boxer's lipped shrapnel shells and fuzes was very good, comparatively few premature bursts, and no failure of ignition of the fuze composition, so far as could be ascertained.

253 Good.
7 Blind.
13 Burst at muzzle

Eight of those which burst at the muzzle were among the first fired. A defect in their construction having been detected was remedied on the spot by Captain Boxer.

With respect to the blind shells Lieut. Colonel Robe, who conducted the practice reported as follows:—

"The mode of priming the fuzes proposed by Captain "Boxer appears to answer perfectly, there not having been "any instance of failure in the bursting of the shell which "could be traced to the non-ignition of the fuze; the only "cases when shells had not burst, were proved to have been "either caused by the extinguishing of the fuze, by grazing "in water, or the fuze was entirely out of the shell when "picked up; and consequently the cause of failure was un-"discoverable. In one instance the fuze proved not to have "been pierced and therefore could not have fired the shell."

The state of the shrapnel shells in store at Woolwich having been carefully examined by the Inspector of Artillery, and his opinion as to the efficiency of a great number of them having been unfavorable, reports also having come from out-stations at home and abroad of an increased number of failures in practice, it was recommended that shrapnel shells and fuzes required to be provided for 1853, should be of Boxer's pattern.

Various modifications in the construction of his fuzes were proposed, but in consequence of failure at the beginning of the trial there has not been time to try all of them.

The equipments with these shells and fuzes have been, this year very unsatisfactory. The failures were at first attributed to the fuzes and slight alterations were made, but without the desired effect.

In order to adapt the shrapnel shells of the Service to Captain Boxer's fuze, 50 were fitted with Gun-metal Bouches, and they were fired at Shoeburyness.

The result was unsatisfactory, though it is by no means certain that the bouching was the cause, for the premature bursts were equally frequent in firing the shells, and all may have proceeded from the same cause, viz. the ignition of the bursting powder by the friction of the balls, and this is rendered more probable, by the result of practice with plugged shells both of Boxer's pattern, and of others cast for the East India Company—50 were fired containing balls without bursting powder, and all were good—50 were fired containing balls and bursting powder, and 17 burst at the muzzle.

It would appear from this Experiment that 34 per cent. of premature explosions, may sometimes be attributable to the contact of the lead balls and bursting powder.

Some of Captain Boxer's shells on being recovered after having been fired were found to be without fuzes, this happened less frequently when fuze holes were roughed. It was probably caused by the projecting head of the fuze being struck in ricochetting.

The bits used for boring into the side holes of Boxer's fuzes, were found to be frequently broken,—they require to be made of superior metal.

CAPTAIN SIEMEN'S HANOVERIAN SHRAPNEL SHELLS AND FUZES.

The balls were fixed in these shells by means of sulphur, a cylindrical space being left under the fuzes for the insertion of the bursting powder.

The shells are carried in the gun limbers loaded, and with the fuzes fixed,

Captain Siemen took great pains with the turning or boring into the fuzes, an operation which requires great care.

The practice was very satisfactory at Shoeburyness in 1853.

There were no premature bursts, and only 3 blind shells out of 100.

Attempts have been made by the Fire Master, Lieutenant Colonel Tylden, to adapt Horizontal Metal Fuzes constructed on similar principles to those of Colonel Bornmann and Captain Siemen's, to shrapnel shells of the service, having the balls fixed in sulphur at the Royal Laboratory at Woolwich.

120 have been fired with full charges for round shot with unsatisfactory results.

Further trials may afford the means of improving their construction, but at present they have not succeeded.

BOXER'S DIAPHRAGM SHELL.

With a view to the separation of the balls from the bursting powder in shrapnel shells, an experiment was made in 1849 with the bursting powder enclosed in canvas bags as suggested by Captain Boxer, and the result having been favorable, he proposed in May 1852, that the separation should be effected by means of a wrought iron plate.

This has been found to answer, 119—8 inch, and 79—24 Pdr. shells, all with 5½ inch Fuzes having been fired with service charges for shot without a single premature explosion.

It has therefore been recommended and approved, that next year's supply of the larger natures of shrapnel shells shall be of this pattern, and that 200 diaphragm shells of each of the smaller natures shall be made for trial.

The various experiments that have been made this year, and previously, with plugged shells with and without bursting powder, as well as the experiments of General Shrapnel, those with Captain Boxer's diaphragm shells—all tend to prove, that whatever other causes may exist for premature explosions, the principal one is, the ignition of the powder by the friction of the balls against each other, or against the side of the shell, and that this may be obviated by the separation of the balls and powder.

In some of the Continental Artilleries this has been effected by fixing the balls with sulphur, pitch, plaster of Paris, or other material.

The Committee have already reported, that they consider Captain Boxer's diaphragm plate preferable, but this mode is not applicable to the shells now in the service.

The accompanying return shews the number of shrapnel shells and fuzes in store at Woolwich, and in considering whether it is desirable to use these shells as they are, to condemn them, or to render them as efficient as possible, it is necessary to remember, that in 1852 every shell that was sent to Shoeburyness, was emptied, cleaned, and refilled with balls, and every fuze prepared and fitted with the greatest care by Lieut. Colonel Robe,—precautions, to which may be attributed, the comparatively small number of premature bursts which occurred, viz. 37 out of 656, or less than 6 per cent.

This year the shells have been fired (without these precautions) as received from store, and as they would be fired at out-stations and on service—Small particles of grit or sand among the balls would no doubt increase the liability to ignition of the powder by friction, and it appears probable, that great care in the preparation, and a temporary partition of moderate strength between the powder and balls, whether of flannel, clay, sulphur, or other substance, would make nearly the whole of these shells serviceable, and it seems advisable that steps should be taken to ascertain what means may be most advantageously used for this purpose.

Among the shells here referred to, those of Captain Boxer's pattern supplied by contract this year are included.

Fuzes for Shrapnel Shells.

With respect to the adoption of a service fuze for shrapnel shells.—The diaphragm shell having been approved of, it is necessary to make choice of that fuze which is best suited to that nature of shell.

Metal fuzes similar in construction to the Naval short range fuze, and wood fuzes of Boxer's pattern were used in the experiment.—Both answered very well; Captain Boxer prefers the wood fuze as being more readily prepared, and it has the advantage of being similar in principle to that which was established in 1850, as the service fuze for common shells; when fired from guns and howitzers.

The other fuzes used in various experiments with shrapnel shells at Shoeburyness were the C. D. E. and inch fuzes; the Belgian fuze, the Hanoverian fuze, (both of which were of pewter with the composition placed horizontally instead of vertically) and the fuzes constructed by Lieut. Colonel Tylden on the same principle, but supported by stronger metal.

The C. D. E. and 1 inch fuzes require alteration to make them efficient and 3 or 4 fuzes must be carried with each shell, as they are prepared for different ranges; when fixed in the shell and primed according to Boxer's method there is no reason to suppose they are less efficient than Boxer's fuze, they are more simple in construction; but in preparation for use, Boxer's fuze has advantages, especially when the time of burning is required to exceed $2\frac{1}{2}$ seconds.—To render this description of shrapnel fuzes serviceable, it is necessary that the C. D. and 1 inch fuzes should be set aside, that the E, F, and G, fuzes should be converted into C, D, and E, fuzes, by boring through the priming $\frac{2}{10}^{\text{ths}}$ of an inch into the composition, also that new inch fuzes $\frac{2}{10}^{\text{ths}}$ of an inch longer in the wood, and bored into and primed according to Boxer's method should be substituted for the old inch fuzes, as has lately been done with fuzes of this kind made for the new field equipments.

Boxer's fuze has been preferred to the old plain fuze for common shells, and there are at least equally good reasons for preferring his fuze for shrapnel shells, to the old plain shrapnel fuze, but the best reason for adopting it now is, that it can be made identical with the Service fuze for common shells, the only difference between them being in the length. The fuzes for common shells having 2 inches of composition, those for shrapnel shells having only 1 inch.

The Belgian and Hanoverian fuzes are of pewter, and this metal is too soft for service, unless the shells are carried loaded and the fuzes fixed. Lieut. Col. Tylden's horizontal fuzes have a foundation of Gun-metal, but they have not yet been brought to perfection.

One of the advantages of the horizontal metal fuze is the regularity as to time of burning.

Being formed in a mould and the composition being pressed at once by machinery, this can be effected with tolerable certainty, provided that the boring is correctly performed, and that ignition takes place on firing; there has in the late experiments been a want of this regularity in the burning of the old fuzes as well as those of Capt. Boxer's pattern.

With equal pressure, and exactness in the length of composition, and position of the side holes, all of which may be secured by machinery in the manufacture of wood fuzes, this defect can be remedied.

Experiments have also been made this year at Shoeburyness with Boxer's short range fuzes, of mealed powder for shrapnel shells, in order to make them available as a substitute for case shot. There were not more premature bursts with them than with other shells, and at 200 yards they acted very well.

The advantages of using shrapnel shells at short ranges instead of case shot are,

1. They do not injure the Gun.

2. They take less room in the limber box and consequently more can be carried.

3. The additional number of shells would be available for long ranges if necessary.

4. If requisite to fire at less than 150 or 200 yards, by inserting the shell in the gun with the fuze next the charge, they will answer the purpose of Case at the shortest possible distance.

COMMON SHELLS AND FUZES.

On the 20th August 1850 after severe trials in practice with shrapnell and common shells, at Woolwich and Shoeburyness, at varieties of ranges and with full service charges for 24 Pdr., 32 Pdr., and 8 inch guns, Captain Boxers' fuze was recommended for adoption into the Land Service for shells discharged from guns and howitzers (The fuzes for shells from mortars remaining as then established), underthe following regulations viz.

No more of the present pattern fuze to be made for the use of guns and howitzers.

The Garrison Service to be first supplied with Boxer's fuzes.

The fuzes for field service and for spherical case shot to be exchanged (for Captain Boxers' pattern) as they become unserviceable, or when any new demands have to be supplied.

This recommendation was approved by the Master General 2d September 1850, but it was afterwards ordered, that none should be issued until the store of fuzes in the Arsenal was exhausted. These are now expended, and Boxers' fuze is therefore the only recognised fuze of the service for guns and howitzers.

In the meantime experiments with shrapnel fuzes upon the same principle have been made, two side channels have been used instead of one, and this great improvement is equally adapted to Boxer's original fuze, as has been proved during the last season at Shoeburyness.

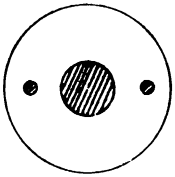
It has further been proved that the $5\frac{1}{2}$ inch fuzes of Boxer's pattern, with two channels, is efficient for all gun aud howitzer shells, from the 12 Pdr., to the 10 inch; the 32 Pdr., 8 inch, and 10 inch shells were fitted with Gun-metal bouches to reduce the fuze holes to the size of the $5\frac{1}{2}$ inch (or 24 Pdr.) fuze hole, and the 12 Pdr. fuze hole, was rimed out to the same size.

384	Good.
21	Blind.
0	Premature.
405	

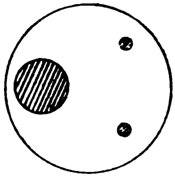
Of the 21 blind shells several were recovered, and the fuzes found to have been extinguished by the graze or out of the shell. No failure of ignition was detected; of the 384 good shells, 59 burst after grazing. There is reason to believe as Captain Boxer has suggested, that the use of wood collars instead of metal bouches would answer the purpose equally well, and this is capable of easy proof.

Another experiment suggested by Lieut. Colonel Wilson Director of the Royal Laboratory, with reference to Boxer's fuzes for common shells has been tried this year with success, viz.

To ascertain whether $5\frac{1}{2}$ inch fuzes concentrically bored and having one channel on each side of the composition, which was of the same diameter as those in $4\frac{2}{5}$ inch fuzes,—also $4\frac{2}{5}$ inch fuzes of similar construction with composition, of the same diameter as that in hand-grenade fuzes, are as efficient as Boxer's $5\frac{1}{2}$ inch fuzes bored eccentrically and with the two channels on the same side. Col. Wilson's object in reducing the diameter of the composition, was to leave as much wood between the side channels and composition as possible in the fuze, which was bored concentrically to save labor; Captain Boxer placed the composition eccentric with the external circumference of the fuze for the same reason, and also for convenience, the odd and even numbers being seen at one glance.



Concentric
with channel
on each side.



Eccentric
with two Channels
on the same side.

From a careful consideration of the results of practice and information obtained, and especially of the foregoing particulars, it appears to be desirable.

1. To separate the powder from the balls in shrapnel shells, in order to prevent the principal cause of premature explosions.

2. To adopt Boxer's mode of priming in vertical fuzes in order to insure ignition of the fuze composition.

3. To adopt Boxer's fuzes with two channels and one inch of composition for all shrapnel shells, and Boxer's fuzes with two channels and two inches of composition for all common shells, to be fired from guns and howitzers, in order to reduce the number of kinds of fuzes as much as possible.

4. To make all fuzes for such shrapnel and common shells of one form and size from the head downwards, the only difference being in the length, in order that fuzes for shrapnel shells may be available for common shells when required.

5. That the fuze holes of all such shells shall be of the same diameter at the exterior circumference and of the same form inwards, the only difference being in the depth, which

must depend on the thickness of the shell, in order that they may be fitted to receive either 1 inch or 2 inch fuzes.

6. That the above mentioned fuzes and fuze holes shall be of the form of Boxer's 5½ inch fuzes, in order to procure uniformity, simplicity, and efficiency, in shells as well as in fuzes, and also their general adaptation to each other.

7. That after the external dimensions and the quality of shells have been tested by the department of the Inspector of Artillery, the Royal Laboratory Department shall be responsible for the cleaning of the inside of all shells, and for the proper form and size of the fuze holes, in order that the fitting of the fuzes into them may be ensured.

8. That all fuze holes shall be roughed at the Royal Laboratory, in order that fuzes may not be liable to be shaken out in ricochetting,

9. That in future, all shells, shrapnel and common, for guns and howitzers, from the 9 Pdr. to the 32 Pdr. inclnsive, shall be cast with fuze holes adapted to Boxer's 5½ inch fuzes.

10. That all shells for guns and howitzers of larger diameter than the 32 Pdr., and cast with large fuze holes, shall be fitted with metal bouches or wood collars, adapted to Boxer's 5½ inch fuzes.

11. That the use of the present store of common shells and fuzes, at Woolwich and elsewhere, shall be continued, in order that due regard may be had to economy as well as to efficiency, and that time may be afforded for carrying into effect the general principles of the foregoing propositions.

12. That the shrapnel shells and fuzes, at Woolwich and elsewhere, shall be made as efficient as possible, the former by the separation of the bursting powder from the balls, and the latter, by boring through the priming $\frac{2}{10}$ths of an inch into the composition of such fuzes as can be prepared for use in this manner, the only precaution necessary to be remembered is,

that the time of burning, will by this means be reduced 1 *second*, and allowance must be made accordingly in preparing fuzes for the different ranges.

13. That when the fuzes in store have been thus made available for the service, (or as many of them as may be considered desirable) any shells that are not supplied with fuzes, shall be fitted with Boxer's 5½ inch fuze, with bouches or collars if necessary.

14. That gauges and rimers for fuze holes shall be furnished to all stations, in order that, inaccuracies, arising from injury to the edges of fuze holes, by accidental causes or otherwise, may be corrected before the fuze is inserted.

WOOLWICH,
9th January 1854.

(Signed) W. CATOR,
D. G.

IV. Memo. on Shrapnel and other Shells.

MEMO. ON SHRAPNEL AND OTHER SHELL PRACTICE AT SHOEBURYNESS IN 1854.

Director General's Office,
Woolwich, *29th December* 1854.

With reference to the following paragraph in the Report of the Select Committee dated 9th January 1854, viz.

"It appears probable that great care in preparation, and a " temporary partition of moderate strength between the pow- " der and the balls, whether of flannel, clay, sulphur, or other " substance would make nearly the whole of these (the old " shrapnel) shells serviceable, and it seems desirable that steps " should be taken to ascertain what means may be most ad- " vantageously used for this purpose."

Steps have been taken and this object has been effected by a plan proposed by Captain Boxer, viz. the introduction of a metal-bouch in the fuze hole of the shell, with a tin cylinder attached to hold the bursting powder.

Several shells were fitted in this manner before General Cator went to Turkey, and with sufficient success to justify the alteration of the shells under preparation for the East.

One Troop, and the first two Field Batteries embarked with the old shells, but others to replace them were afterwards forwarded, and the whole of the Field Batteries, Siege Train and guns of position, have been furnished with shrapnel shells rendered serviceable by the above method.

So efficient has this proved, that during the whole of the experimental practice at Shoeburyness this summer, in which many of these shrapnel shells of all natures have been fired, not a single premature burst has taken place, so that the object for which the alteration was made has been most successfully attained.

In the practice of the companies under instruction, two premature explosions occurred, but these failures may fairly be attributed to causes distinct from any fault of the principle adopted.

Of blind shells during the practice there have been several latterly, but of those it is not unreasonable to suppose that nearly all were attributable to imperfect boring, or extinction of the fuze by striking on the wet sand.

The following is an extract from a letter from Colonel R. Wilson the Officer in charge of experiments and practice at Shoeburyness respecting shells which did not burst.

"The first (I conceive) imperfectly bored.
" 2d Same cause.
" 3d Fuze knocked out on striking the sand.
" 4th Shell struck the ground and smashed the fuze.
" 5th Fuze out, evidently badly driven, the whole of the collars remained in uninjured."

"I think Boxer's fuze the best I have ever seen—with care
" they never fail."

One fuze was blown out by the explosion of the bursting powder, without bursting the shell.

The result of the practice generally, has proved the very great advantage gained to the service by the adoption of the principle of separating the powder from the balls in the shell, and of boring a small hole in the head of the fuze composition, the one preventing premature explosion, the other securing the ignition of the fuze composition.

The experiments during the summer however, while they have been extremely satisfactory with regard to these two main points, shewed an irregularity as to the time of burning the composition in the fuzes, which required correction and eventually led to the discovery, by Captain Boxer, that the grease, with which the instruments used for boring were touched in the manufacture of the fuzes, was communicated to the wood, and ultimately to the fuze composition, increasing its time of burning, and otherwise affecting its efficiency.

The discovery is particularly valuable, as it also accounts for the defects in Rocket fuzes, which have, for many years, been prepared in a similar manner, and have been injured by a similar cause.

This defect in all wood fuzes has now been remedied by the disuse of grease.

With respect to the shells also which have been filled with balls separated from the bursting powder, the composition in which they were at first embedded, was found occasionally to adhere with some of the balls to the side of the shell.*

Resin has been substituted, and this evil diminished, if not entirely remedied.

The bursting powder, being collected nearly in the middle of the shell a greater lateral spread, and less longitudinal spread of the balls is thereby produced, though the area they cover, is much the same.

The carbine balls in the smaller natures of shells have been found very efficient, as appears by a letter from Captain Brandling dated 24th May 1854; although latterly Colonel

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* It consists of Plaster of Paris, red ochre and resin—a mixture containing red lead was also tried but found to be too hard

Wilson has complained of want of penetration, which he attributes to the solidity of the composition used for fixing the Balls,—

This may be rectified by the substitution of resin.

It has been proposed to harden the lead balls by mixing them with antimony.

Iron balls have also been suggested for the larger natures of shells.

These Shrapnell shells are now considered secure against premature explosion, even if fired with full charges for solid shot.

In all the experiments that have been made with the future shrapnel shell of the service viz. The Diaphragm shell, as well as with those referred to in the accompanying paper No. 2 containing Captain Boxers Report of practice at Shoeburyness this month, full charges have been used with perfect safety, and it is suggested that great advantage and convenience would arise from adopting generally for shrapnel shells the same charges as are used for solid shot.

In shell guns and large natures of ordnance of cast iron this rule will require some modification (The charge for the 32 Pdr. common shell has lately been reduced); hollow shot for 8 inch Guns weigh only 48 lbs. while the Shrapnel shell for the same guns weighs 61 lbs.

The measures adopted for the improvement of the old Shrapnel shell having thus been attended with great success, as evidenced by the experiments at Shoeburyness, as well as by most satisfactory Reports of their efficiency in the Crimea, it is suggested that a more extensive application of these improvements may now safely be effected, and steps taken for providing outstations at home and abroad with equally good shells.

In considering the necessity for this change, it must be remembered that the old shells have been found as formerly prepared, so inefficient, that no dependence can be placed on them.

The same remark applies to the old fuzes. Both should therefore be changed as soon as possible.

Instruments should be issued for the use of the new shells and fuzes, and also rimers, gauges, and other requisite small stores.

It may be desirable to have the tin cylinders for the bursting powder lacquered, to prevent rust.

No experiments with short range fuzes for Shrapnel shells, have been made this year, but the proposition is still open and deserving of further trial and consideration.

The introduction of exercise Shrapnell shells as suggested 9th January 1854 will be very useful, as soon as the exact weight of the various natures of the new Diaphragm Shrapnel shell has been determined.

The common shells for guns and howitzers, and Boxer's 5½ Inch fuzes, have been found to answer extremely well, and their use also should now be extended to all stations.

In the practice with mortars at Shoeburyness this year, several shells have burst prematurely, and the Reports from the East of the 10 Inch mortar shells and fuzes are very unsatisfactory.

The Firemaster has made some experiments, and proposes that all shells for 8, 10, & 13 Inch mortars should have fuze holes, adapted to 8 Inch fuzes prepared with side holes partially bored, (see the annexed letter from the Director of the Royal Laboratory No. 1 dated 14th November 1854 enclosing Captain Boxer's Report of practice with mortars at Shoeburyness.)

These fuzes and fuzeholes are 1.22 inches in diameter at the head, and taper gradually to a point at the distance of 16.2 Inches.

All shells for mortars as well as for guns and howitzers should be subjected before issue to Laboratory inspection. Experiments should be made with $5\frac{1}{2}$ Inch and $4\frac{2}{5}$ Inch mortar shells, to ascertain if Boxer's $5\frac{1}{2}$ fuzes for common shells can be used with them.

Experiments are about to be made, to ascertain if the concussion fuze of the service, which is at present only used with 32 Pdr. and the higher natures of common shells, can be reduced to the size of the $5\frac{1}{2}$ Inch fuze hole.

If not, shells having 8 Inch fuze holes must as heretofore be used with them.

Fuzes for hand grenades, as well as all other time fuzes should have $\frac{2}{10}$ of an Inch bored into the composition.

Wood collars for fuzes have been found unfit for general use, the wood being liable to shrink and to split.

SHRAPNEL SHELLS AND FUZES.

With reference to the foregoing Memo : and to the Memo : and 14 Propositions (9th January 1854) which received the approval of the Master General, it is now suggested in addition, with regard to shrapnel shells and fuzes.

1. That the old Shrapnel shells of the service shall, when possible, be rendered efficient by the introduction in the fuze hole, of a metal bouche with a lacquered tin cylinder attached, to hold the bursting powder.

2. That the charges of these Shrapnel shells shall be according to the annexed table A.

3. That their bursting charges shall consist of rifle powder, and shall be issued in paper bags enclosed in calico,—filled according to the annexed table marked B.

4. That the balls shall be inserted by a small hole bored for that purpose in the shell, that they shall be embedded in resin,—and that the hole shall be plugged with wood, before being issued for practice or service.

5. That antimony may be mixed with the lead balls.

6. That immediate steps be taken to provide outstations with Shrapnel shells of the above description, and to with-

draw those in charge of the several Commanding Officers and Storekeepers, in such manner as may be suggested by the Director General of Artillery, for the purpose of being fitted at Woolwich.

7. That Boxer's Shrapnel fuzes shall be issued with such shells, and the old Shrapnel fuzes withdrawn with the old shells.—The number of fuzes issued, to be 20 per cent. more than the number of shells, in order that the men may have the opportunity of being taught the preparation of fuzes for use.

8. That gauges and rimers be issued to all stations, in due proportion, for the purpose of rectifying any irregularities that may occur in fuze holes, from accidental causes in transport or otherwise.

9. That borers, bits and other small stores for Shrapnel fuzes, may be issued according to the annexed table C.

10. That all common shells and fuzes for guns and howitzers be withdrawn from the out stations, and brought to Woolwich, (that the shells may be examined, and as many of them as possible, fitted to Boxers 5½ Inch fuze) under a similar arrangement to that proposed for the withdrawal of Shrapnel shells and fuzes, (as many as considered necessary by the Director General being replaced by efficient shells, and Boxer's 5½ Inch Fuzes).

11. That the 8 Inch fuze with side holes shall be adopted in the service for shells, hereafter cast for mortars.

12. That all 8, 10, and 13 Inch shells hereafter cast for mortars, shall have their fuze holes adapted to the 8 Inch fuze.

13. That until such shells are cast, fuzes with side holes shall be made for adjustment to the fuze holes of the 8, 10, & 13 Inch mortar shells now in the service, and shall be used with such shells.

14. That after the external dimensions, quality, and uniform thickness of shells for mortars, as well as for guns and

howitzers, have been tested by the Department of the Inspector of Artillery, the Royal Laboratory Department shall be responsible for the cleansing of the inside of the shells before they are issued, and for the proper form, roughing and dimensions of the fuze holes.

15. That fuzes for mortar shells as well as for all other shells, shall in their construction, at the Royal Laboratory, be bored, not less than $\frac{2}{10}$ths of an inch into the upper part of the fuze composition.

(Signed) W. Cator.
Director General.

TABLE A.

No.	Nature of Ordnance.	Length.	Weight.	Charge.	Remarks.
		Ft. In.	Cwt.	lbs.	
	IRON.				
1	68 Pdr. Gun.	10—10	112	10	
2	68 Pdr. ,,	10— 0	95	10	
3	8 Inch. ,,	9— 0	65	8	
4	8 Inch. ,,	8— 0	52	6	
5	8 Inch. ,,	6—8½	50	6	
6	56 Pdr. ,,	10— 0	85	10	
7	42 Pdr. ,,	10— 0	84	10	
8	42 Pdr. ,,	10— 0	75	10	
9	42 Pdr. ,,	9— 6	67	10	
10	32 Pdr. ,,	9— 7	63	10	
11	32 Pdr. ,,	9— 6	56	10	
12	32 Pdr. ,,	9— 0	50	8	
13	32 Pdr. ,,	8— 0	42	6	
14	32 Pdr. ,,	6— 0	25	4	
15	24 Pdr. ,,	9— 6	50	8	
16	24 Pdr. ,,	6— 0	20	2½	
17	18 Pdr. ,,	9— 0	42	6	
18	12 Pdr. ,,	6— 0	21	4	
19	6 Pdr. ,,	6— 0	17	2	
20	8 Inch Howitzer.	4— 0	21	3	
	BRASS				
1	12 Pdr Gun	6— 6.6	17½	4	
2	9 Pdr. ,,	5—11.4	13½	2½	
3	6 Pdr. ,,	5— 0	6	1½	
4	32 Pdr. Howitzer.	5— 3	17½	3	
5	24 Pdr. ,,	4— 8.6	12½	2½	
6	12 Pdr. ,,	3— 9.2	6½	1½	

(Signed) W. Cator,
Director General.

TABLE B.

Bursting charges for Shrapnel Shells which have the powder separated from the balls by means of tin cylinders.

	ozs.	drs.	
8 Inch shells.........	4	3	Rifle Powder
56 Pdrs. ,,	4	2	,,
42 Pdrs. ,,	2	12	,,
32 Pdrs. ,,	2	8	,,
24 Pdrs. ,,	1	9½	,,
18 Pdrs. ,,	1	8	,,
12 Pdrs. ,,	1	0½	,,
9 Pdrs. ,,	0	14	,,
6 Pdrs. ,,	0	9½	,,

(Initialed) W. C.
D. G.

TABLE C.

List of Borers, Bits and other small stores for Shrapnel and other Shells.

	Boring Implements. Sets	Funnels.	Fuze Boxes.				Fuze Bags				Rectifying Implements. Sets	Implements for boring Mortar Fuzes.
			Blue containing		Black containing		Blue containing		Black containing			
			8 Shrapnel fuzes	12 Shrapnel fuzes	10 Common fuzes	8 Common fuzes	8 Shrapnel fuzes	12 Shrapnel fuzes	10 Common fuzes	16 Common fuzes		
9 Pdr Battery.	1 For each Gun and Howitzer	2 For each Gun and Howitzer	26	,,	7	,,	16	,,	10	,,	1	1 For every Mortar
6 Pdr Battery.			,,	17	,,	10	,,	21	,,	10	1	
Battering Train. Guns of Position Foreign Stations &Coast Batteries				2 For each Gun and Howitzer	2 For each Gun and Howitzer	The number will depend on circumstances					1 For each 5 Guns	

A set of Rectifying Implements.
2 Rimers.
1 Gauge.

A set of Borers.
2 Borers.
12 Long Bits.
1 Handle.
12 Short Bits.

A set of Implements for boring mortar fuzes.
1 Brace.
5 Bits.

(Signed) W. CATOR. *D. G.*

No. V.—FUZES.

ADDENDA BY CAPTAIN C. H. HUTCHINSON.

Several shells having failed to burst, it was supposed that the lead plug *b*, (Fig. 1 Plate 2) had become displaced, either by the first shock of firing, or by the friction of the balls during the after flight of the shell, (more probably the former) and that the coal dust getting into the socket had choked up the passage leading to the bursting powder and caused the failure. This has led to the substitution of a plug of brass made to screw down upon a shoulder left at the bottom of the socket: the inside of the socket has also been turned out so as to enlarge the small channel at first used, communicating with the hole into a cavity extending all round the fuze, with the effect of considerably reducing the number of blind shells.

Officers who witnessed the shell firing in the Crimea, speak very favorably of the accuracy with which the bursting of shells was timed by the use of Boxer's Fuzes. And so highly were they appreciated also by the French Artillery, that large quantities were applied for by our Allies, and supplied to them at various times from the Woolwich Arsenal.

The Royal Artillery have established, that wooden fuzes for Mortar Shells shall be confined to two sizes only: these are shewn drawn to the full scale on the accompanying plates. (I and 2)

Great accuracy in their size, shape, and graduation is ensured by the use of machines, specially adapted to perform each step in their preparation.

These consist essentially of:—

1 Circular saws for cutting the wood into prisms of the two sizes required.

2 Set at the proper angle upon a lathe, is a guide rest, against which the hand is stopped whilst roughly shaping out the fuze, after the manner of hand turning; a second chisel, secured to a handle carrying a gauge stop to traverse against

the same guide rest, finishes every cone with a side parallel to and equidistant from the guide rest.

3 Held in the conical hole of a rest confined between guides, the fuze is brought up to two circular saws, set exactly the length of a fuze apart, by which the same length and same thickness is ensured to all.

4 A revolving chuck has a conical hole in its centre to receive the fuze, whilst the cup is turned out by a cutter, sliding in a puppet head, and fitted with a collar to stop it at the proper depth.

5 A similar arrangement, with the substitution of a bit to bore out the fuze.

6 Sharp disks of steel set one inch apart upon a revolving bar, cut or indent the graduation rings on the fuze, retained by end blocks in its correct position, and pressed to the cutters by a short lever.

7 A rest, in which a determinate spiral end motion is given to the fuze, and by which it is brought, and held in the right positions for the side holes being successively bored, by a bit fixed in a revolving prandiel, capable of restricted end motion, in the direction of a diameter of the fuze.

8 For Shrapnel fuzes a revolving bit is used to form the bore, the fuze being held in a rest, of which the conical hole has the proper amount of axial eccentricity, with reference to the direction of the bit.

9 Smaller bits under the same sort of arrangement are used to bore the side channels.

All these bits, excepting the cup borer, which is sufficiently stiff in itself, pass the whole of a steel guide plate fixed close to the mouth of the fuze; to ensure a true direction of the bore.

10 A rest, having determinate end motion and revolution, and fitted with apprcpriate stops to determine its position holds the fuze, whilst the side holes are bored by a revolving bit.

Plate 1.

3.

BORER FOR FUZE.

Fig. 10.

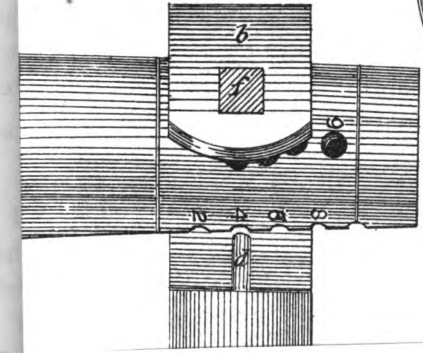
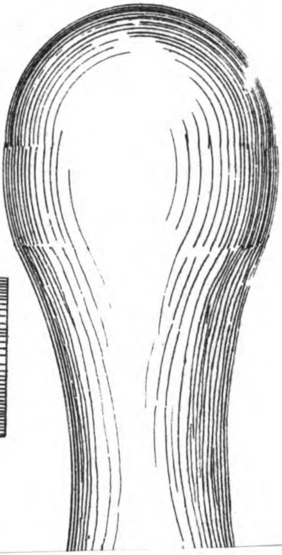


Fig. 12.



The metal caps are made of pure tin, laminated, punched into disks, and spun into shape upon a lathe, specially fitted for the service. A peculiar plan of punching will now be adopted, in supercession of the spinning process for forcing up the rims of the caps.

This consists in using a die with a hole of just sufficient size to allow the finished cap to pass; through which the disk of tin will be forced by a punch as large as the inside diameter of the finished cap, over the die and so close to it as barely to admit of the metal disk being inserted below it, will be fixed a plate of steel pierced with a hole just large enough to allow the punch to pass; this plate, it is now discovered will prevent the edges of the tin disk from crumpling up in punching; an effect, which has hitherto prevented the simple, and more rapid method of punching being used for forming the disks into cups.

No. VI.—Boxer's Fuzes for common and Shrapnel Shells. Plate I.

DESCRIPTION.

Figs. 4 and 5, represent sections of the fuze for common shells, and figs. 7 and 8, sections of the fuze for shrapnel shells.

The composition bore *c,c*, is made eccentric with regard to the exterior, and the two powder channels *d, d*, are bored upon that side in which there is the greatest thickness of wood.

A hole is bored through the mealed powder at the top, and into the fuze composition, to a depth of about ·4-inch from the end of the composition bore; this hole is of the utmost importance, as it ensures the igintion of the fuze composition from the priming.

Holes *e,e*, ·2 of an inch apart, are made into the powder channels; the top hole in one row is ·2-inch from a plane passing through the bottom of the priming hole, and perpendicular to the axis of the fuze; and the top hole in the other row is ·3-inch from this plane.

The bottom hole in each row is continued to the axis of the composition bore. The small side holes *e,e,* with the exception of the bottom ones, are filled with pressed powder, and a small portion of clay.

The powder channels *d,d,* contain fine powder, and the bottom side holes *e,e,* have a piece of good quickmatch placed in them. Beyond this quickmatch, the powder channels in the fuze for common shells is filled with putty, but in the fuze for shrapnel shells, the corresponding portion contains quickmatch, which is continued from one channel to the other through a groove made in the bottom. In the former, the powder is prevented from being "set" into the shell by the quickmatch and putty; but in the latter, the quickmatch alone offers the necessary resistance.

A piece of good quickmatch is tied into the cup, and it is recommended that this quickmatch be laid over the side before the shell is set home.

Figs. 6 and 9, represent the common and shrapnel fuzes, with the side holes numbered.

Borer for the fuze.—The borer fig. 10, consists of a hook *b,* into which the fuze is placed, as shewn in the fig, and a shank *a,* which contains a female screw. The bit fig. 11, passes through the centre of the handle and male screw, and is secured by a small screw *e,* which presses upon the portion of the bit *g,* The length of the bit is so regulated, that when placed in the handle as shewn in the drawing, it will enter sufficiently far into the composition when screwed down to the shoulder.

If the bit should become unserviceable, the handle must be detached from the shank, and *e,* unscrewed, by placing the head into the recess *f,* (the hook thus becomes a turnscrew,) by turning the bit ¼ round, a portion will project beyond the handle, and thus facilitate its removal, should it be tightened by rust or other causes. Care must be taken in substituting another bit, that it is placed as shewn in the figure, and that the screw *e*, firmly presses upon it, for if any space be left between the head of the bit and the handle, the end will not enter sufficiently far into the composition. The borer should be occasionally examined and cleaned.

Fig 1. represents a section of the common shrapnel shell, so arranged as to have the bursting powder separated from the balls, with the new fuze fixed and prepared for a range corresponding to two seconds.

The bursting powder *c*, is contained in a tin cylinder, and is admitted through the hole *d*, at the bottom of the socked *b*. When the composition is consumed as far as the hole *a*, (made by the borer,) the fine powder in the channel is ignited, and thus explodes the bursting powder through the hole *d; e* is a small hole at the side of the shell through which the balls and rosin, which is run between them, is admitted, and this is then closed by a plug of wood.

It is recommended that the bursting powder be placed in the tin cylinder before going into action, and the plug covered with serge, inserted in the fuze hole. The bursting powder can be speedily removed from the shell if necessary, and from its being separated from the balls, and consequently not acted upon by them, it will not be liable to injury even when subjected to the action of travelling.

A simple boring bit fig. 12, is supplied to each gun, in case the one represented in the figure be lost, but this should not be used, except in case of necessity.

Directions for preparing and fixing the Fuze.

Hold the borer by the handle in the right hand; place the fuze in the hook with the head of the fuze towards the body, and in such a position that the "bit" in advancing will pierce the required hole, then holding the hook of the borer in the left hand; turn the handle until the "bit" enters the hole, after which the fuze must not be confined by the hand; continue to turn the screw until the shoulder comes in contact with the top of the shank, reverse the motion until the bit is clear of the fuze; remove the fuze; push down the string which secures the cap; place the fuze in the socket of the shell; give the head of the fuze two or three smart taps, either with a small wood mallet, or against the gun carriage.

VII.—Boxer's Fuzes and Diaphragm Shrapnel Shell. Plate 2.

DESCRIPTION.

Fuze for Common aud shrapnel shell.

Figs. 2 and 4 represent sections of the fuze for common shell, and figs. 9 and 11, sections of the fuze for shrapnel shell.

The composition-bore *c,c,* is made eccentric with regard to the exterior, and the two powder-channels *d,d,* are bored upon that side in which there is the greatest thickness of wood, as shewn in fig. 8.

A hole is bored through the mealed powder at the top, and into the fuze composition, to a depth of about ·4 inch from the end of the composition-bore: this hole is of the utmost importance, at it ensures the ignition of the fuze-composition from the priming.

Holes *e,e,* ·2 inch apart, are made into the powder-channels; the top hole in one row is ·2 inch from a plane passing through the bottom of the priming-hole, and perpendicular to the axis of the fuze; and the top hole in the other row is ·3 inch from this plane.

The bottom hole of each row is continued to the axis of the composition bore. The small side holes *e,e,* with the exception of the bottom ones, are filled with pressed powder and a small portion of clay.

The powder-channels *d,d,* contain fine powder, and the bottom side holes *e,e,* have a piece of quick match placed in them. Beyond this quickmatch, in the fuze for common shell, the powder-channels are filled with putty, but in the fuze for shrapnel shell, the corresponding portions contain quickmatch, which is continued from one channel to the

Plate 2

other through a groove made in the bottom. In the former, the powder is prevented from being "set" into the shell by the quickmatch and putty; but in the latter, the quickmatch alone offers the necessary resistance.

Figs. 3 and 10 represent the common and shrapnel fuzes, with the side holes numbered.

Fig. 6 represents the metallic cap which is fixed on the head of the fuze; in the inside of this cap is placed a disk of cardboard, to which is attached a piece of tape, as shewn in fig. 7. Fuzes with the metallic cap fixed are shewn in figs. 12 and 13.

Fuze for Mortar shells.

Fig. 12 represents the fuze for 13, 10, and 8 inch mortar-shells. This fuze has a spiral row of holes, the centres of which are ·2 inch apart in the direction of the axis of the fuze. The holes are made in a spire, in order to prevent the wood from splitting when preparing the fuze for firing,—a defect which existed when the holes were arranged as in the common and shrapnel fuzes.

Borers for Fuzes.

The borer, fig. 13, for common and shrapnel fuzes, consists of a hook *b*, into which the fuze is placed, as shewn in the plate, and a shank *a*, which contains a female screw. The bit, fig. 14, passes through the centre of the handle and male screw, and is secured by a small screw *e*, which presses upon the portion of the bit *g*. The length of the bit is so regulated, that when placed in the handle, as shewn in the drawing, it will enter sufficiently far into the composition when screwed down to the shoulder.

If the bit should become unserviceable, the handle must be detached from the shank, and *e* unscrewed, the square hole *f*, in the hook *b*, being made for this purpose. By turning the bit a quarter round, a portion will project beyond the handle, and thus facilitate its removal. Care must be taken, when substituting another bit, that it is placed as shewn in fig. 13, *and that the screw* e *firmly presses upon* g, *fig.* 14; *for if any space be left between the handle and the head of the bit, the end will not enter a sufficient depth into the composition.* The borer should be occasionally examined and cleaned.

A simple boring bit, fig. 15, is supplied to each gun, in case the one represented in fig. 13, should be lost; but this should not be used except in case of necessity.

Fig. 16, represents the brace and bit for mortar fuzes.

Boxer's Diaphragm shrapnel shell.

Fig. 1, shews a section of Boxer's Diaphragm shrapnel shell, with a fuze fixed and prepared for a range corresponding to 2 seconds. The interior of this shell is divided by a wrought-iron partition or diaphragm, *d*. The balls *e,e,* are placed on one side of the diaphragm, and the powder on the other, a complete separation being thus effected.

The balls are made of an alloy of lead and antimony, and the interstices are filled up with coal dust.

A metal socket is screwed into the fuze-hole; this socket has a shoulder which *presses* upon the diaphragm, thus rendering the separation of the powder and balls complete.

The bursting powder is admitted into the shell through a small hole *f*; this hole is secured by a small metal screw-plug. It is recommended that the bursting-powder be put in the shell before going into action, as it can be speedily removed from the shell if necessary, and from its being separated from the balls, and consequently not acted upon by them, it will not be liable to injury, even when subjected to the action of travelling.

In order that the bursting charge may open the shell in such a manner as to relieve the balls without affecting their proper direction of flight, four grooves are cast in the interior of the shell.

When the composition is consumed as far as the hole *g*, (made by the borer), the fine powder in the channel is ignited, the fire is then conveyed from the bottom of the fuze to the bursting-powder, through a small groove, which is made from the end of the socket to the hole *a*.

The interior of the socket is of such a length that a vacant space exists between the bottom of the fuze and the plug of lead *b*, which closes the end of the socket, and which insures the ignition of the bursting-charge, whatever position the fuze may be in.

Directions for preparing and fixing Fuzes.

To prepare the fuze for common and shrapnel shell, hold the borer, fig. 13, by the handle in the right hand; place the fuze in the hook *b*, with the head of the fuze towards the body, and in such a position, as shewn in fig. 13, that the "bit" in advancing will pierce the required hole; then, holding the hook of the borer in the left hand, turn the handle until the "bit" enters the hole, after which the fuze must not be confined by the hand; continue to turn the screw until the shoulder comes in contact with the top of the shank; reverse the motion until the "bit" is clear of the fuze; remove the fuze and place it in the socket of the shell, and give the head of the fuze two or three smart taps, either with a small wooden mallet or against the gun-carriage. Care must be taken that the fuze is fixed firmly in the shell, but it is on no account to be rasped.

The fuze must not be uncapped until the shell is placed in the muzzle of the gun. The cap is then removed by giving the tape a sharp pull.—This operation not being performed until the shell is in the bore, much reduces the chance of an accident, and renders the fuze less liable to injury from wet.

To prepare the fuze for mortar shells.—Hold the fuze, fig. 12, firmly in the left hand; insert the point of the bit, fig. 16, into the required hole; place the head of the brace against the body, and turn with the right hand until the stop comes in contact with the wood. In fixing and uncapping the fuze, the same directions must be attended to as given for the common and shrapnel fuze.

N. B. The wooden bottom of the fuze must on no account be cut off, as it supports the composition, and prevents its being disarranged by the shock at the discharge.

When filling mortar-shells, the cork plug, which is in the fuze-hole of the 13 and 10-inch, may be driven in by the fuze; but with the 8 inch, the plug ought to be taken out, as it might prevent the fuze from being "set home." The mortar-shells were at first filled with wooden plugs; these must be removed by means of a mallet and piece of metal.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes, and Fuze-hole.*

Shoeburyness, 18th May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from target.		Height of Burst above the Plane.	1st Graze of Shell	Barometer 29·375. Thermometer 55° Wind N. N. West 4. Direction of Range S E × East. Distance between Targets, only 1 Target used. Size of Targets. 6 × 6 feet.
Shell.	Fuze.											Short.	Beyond.			Remarks.
			Ft. In.		lbs.oz.	lbs.oz.	Deg	Ins.	Seconds. 5ths	Ft. In	yds.	yds.	yds.	Ft.	yards.	
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze	1	15 Feet.	10 In. Howitzer.	7	5 8	5½	1·2	6-3	Not taken.	1400	not obsd.		not obsd.		
		2			„	„	6	1·2	6-1			do.		on plane.		
		3			„	„	6	1·2	6-1			do.		not obsd.		
		4			„	„	6	1·2	5-4			„	30	not obsd.		
		5			„	„	6	1·1	not obsd.			„	„	at target.		
		6			„	„	6	1·1	5-3			50	„	on plane.		
		7			„	„	6	1·1	5-2			10	„	do		
		8			„	„	6	1·1	5-4			5	„	not obsd.		
		9			„	„	6	1·1	6-			„	5	on plane.		
		10			„	„	4	·9	not obsd.			60	„	do		21st May 1855.
		11			„	„	4⅛	9	„			30	„	„		Did not burst-Shell found with Fuze out
		12			„	„	4⅛	·9	4-3		1100	Burst	after	grazing.		Time to 1st graze.
		13			„	„	4⅛	·8	4-0			8	„	on plane.		
		14			„	„	4⅛	·8	4-1			3	„	do		
		15			„	„	4⅛	·8	4-0			30	„	do		
		16			„	„	4⅛	·8	not obsd.			at target		do		
		17			„	„	2⅞	·6	„		1000	100	„	„		
		18			„	„	3⅛	·6	3-1			5	„	on plane.		Did not burst, Fuze extinguished.
		19			„	„	4	·7	„			„	„	„		
		20			„	„	4	·7	„			„	50	on plane.		Burst at the Muzzle.

The Director General of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. } *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes and Fuze-hole.*

Shoeburyness, 18*th May* 1855.

Description of Shell.	Description of Fuze.	No. of Rounds.	Height of Axis of Gun above the Plane. Ft. In.	Nature and weight of Ordnance.	Charge. lbs.oz.	Bursting Powder.	Elevation. Deg.	Length of Fuze. Ins.	Time of Flight to Burst of Shell. Seconds. 5ths	Recoil. Ft. In.	Range to Target. yds.	Burst from Target. Short. yds.	Burst from Target. Beyond. yds.	Height of Burst above the Plane. Feet.	Barometer 29 375. Thermometer 55° Wind N. N. West 4. Direction of Range S.E. × East Distance between Targets, only 1 Target used Size of Targets. REMARKS.
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	1	15 Feet.	24 Pdr 50Cwt	8	,,	4	·9	not obsd.	Not taken.	1400	not obsd.		,,	Shell burst.
		2		,,	,,	,,	4	·9	4-4			do.		,,	{Time to 1st graze, did not burst, extinguished.
		3		,,	,,	,,	4	·8	4-1			do.		,,	
		4		,,	,,	,,	4	·8	4-1			50	,,	not obsd.	
		5		,,	,,	,,	4	·8	4-0			20	,,	5	
		6		,,	,,	,,	4	·8	4-0			50	,,	20	
		7		,,	,,	,,	4	·8	4-1			10	,,	not obsd.	
		8		,,	,,	,,	4	·8	4-0			5	,,	do.	
		19		,,	,,	,,	3¾	·8	4-1			at target.		10	
		10		,,	,,	,,	3½	·8	4-0			,,	,,	on plane.	Burst in the water.
		11		,,	,,	,,	3½	·8	4-1			not obsd.		,,	
		12		,,	,,	,,	3	7	3-3		1100	30	,,	High in the air	21st May 1855.
		13		,,	,,	,,	2¾	·7	3-2			not obsd.		,,	Shell burst.
		14		,,	,,	,,	2½	·7	3-3			,,	,,	,,	Burst after grazing.
		15		,,	,,	,,	2½	·6	4-0			,,	80	on plane.	
		16		,,	,,	,,	2½	·6	3-2			,,	40	do.	
		17		,,	,,	,,	2⅝	·5	2-3			80	,,	High in the air	
		18		,,	,,	,,	2½	·6	3-3			,,	15	on plane.	
		19		,,	,,	,,	1½	·4	2-0		1000	40	,,	High in the air	
		20		,,	,,	,,	1½	·5	2-3			,,	8	on plane.	

The Director General of Artillery.

No. 1·

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes, and Fuze-hole.*

Shoeburyness, 18th May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	Barometer 29·230., Thermometer 55.° Wind S. S. East 4. Direction of Range S.E.×East Distance between Targets, only 1 Target used. Size of Targets 6 × 6 feet.
Shell.	Fuze.		Ft. In.		lb. oz.		Deg	Ins.	Seconds.	Ft. In.	yds.	Short. yds.	Beyond. yds.	Feet.	Remarks.
									5ths						
Common Shells sent to Shoeburyness 5th May 1855.	Captain Boxer's large Cone.	1	15 Feet.	8 Inch Gun 65 cwt.	lbs. 10	lbs.oz. 2-4	3½	·7	4-1	Not taken.	1400	not obsd.		not observed.	Shell burst.
		2					3½	·7	4-1			150	,,	on plane.	
		3					3¾	·7	3-4			not obsd.		not observed.	Shell burst.
		4					3¾	·8	4-1			50	,,	on plane.	
		5					3¾	·8	4-0			50	,,	3	
		6					3¾	·8	4-1			at the target.		,,	
		7					3¾	·8	4-1			15	,,	on plane.	
		8					3¾	·8	4-1			10	,,	4	
		9					3½	·8	4-0			30	,,	on plane.	
		10					3½	·8	4-0			not obsd.		,,	Both shells burst.
		11					3½	·8	4-1		1100	Do.		,,	
		12					2½	·5	2-4			40	,,	6	21st May 1855.
		13					2¼	·6	not obsd.			at the target.		on plane.	Burst on grazing.
		14					2¼	·6	3-4			10	,,	do.	Time of Flight taken to 1st graze burst some time after.
		15					2¼	·6	4-0			,,	,,	,,	Burst 300 yards beyond target while grazing.
		16					2¼	·6	3-4			10	,,	,,	Did not burst, Fuze out.
		17					2¼	·6	3-0			8	,,	10	
		18					2¼	·6	not obsd.			,,	10	on plane.	
		19					2¼	·4	2-1		900	5	,,	do.	
		20					2¼	·5	2-3			over target.		10	

The Director General of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. } *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes and Fuze-hole.*

Shoeburyness, 18th May 1855.

Description of Shell.	Description of Fuze.	No. of Rounds.	Height of Axis of Gun above the plane. Ft. In.	Nature and weight of Ordnance.	Charge. lbs. oz.	Bursting Powder.	Elevation. Deg	Length of Fuze. Ins.	Time of Flight to Burst of Shell. Seconds. 5ths	Recoil. Ft. In.	Range to target. yds.	Burst from Target. Short. yds.	Burst from Target. Beyond. yds.	Height of Burst above the Plane. Feet.	Barometer 29·230. Thermometer 75° Wind S. S. East. 4 Direction of Range S.E. × East Distance between Targets, only 1 Target used. Size of Targets 6 × 6 Feet. **Remarks.**
Common Shells sent to Shoeburyness 5th May 1855.	Captain Boxer's Large Cone.	1	20 Feet.	68 Pdr Gun 95 cwt.	lbs. 10	lb. oz. 2-4	3	·7	4-1	Not taken.	1400	100	„	3	
		2					3¼	·7	4-1			150	„	on plane.	
		3					3½	·7	3-3			not taken		not taken.	
		4					3½	·8	4-1			5	„	on plane.	
		5					3½	·8	4-2			„	„	„	Did not burst, Fuze burnt its time but was extinguished by grazing, Time of flight taken to 1st graze.
		6					3½	·8	4-1			50	„	on plane,	
		7					3½	·8	4-1			15	„	do.	
		8					3½	·8	4-2			10	„	do.	
		9					3½	·8	not obsd			5	„	do.	
		10					3½	·8	4-2			„	„	do.	
		11					3½	·8	4-2			„	„	„	Burst after 3d graze–Time of flight taken to 1st graze.
		12					1¾	·5	2-4			50	„	on plane.	21st May 1855.
		13					2	·6	3-0		1100	„	„	„	
Rounds 15 and 16, Fuzes were not correctly bored in consequence of an accidental shifting of the bit.		14					2	·6	3-4			70	„	on plane.	Did not burst, Time of flight given to 1st graze.
		15					2¼	·6	3-2			„	40	„	Burst at 2d graze, Time of flight given to 1st graze.
		16					3	·7	4-2		1400	„	„	„	Burst at3d graze, Time of flight to 1st [graze.
		17					2½	·6	3-0		900	10	„	on plane.	
		18					2½	·6	3-2			„	10	do.	
		19					2	·4	2-1			80	„	do.	
		20					2	·5	2-3			„	3	10	

The Director General
of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. } *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes, and Fuze-hole.*

Shoeburyness, 21st May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and Weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	Barometer. } Not noted. Thermometer. } Not noted. Wind. } Not noted. Direction of Range S.E. × East Distance between Targets, only 1 Target used. Size of Targets.
Shell.	Fuze.											Short	Beyond.		REMARKS.
			Ft. In.		lbs. oz.	oz.	Deg	Ins.	Seconds.	Ft. In.	yds.	yds.	yds.	Feet.	
									5ths						
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	1	10 Feet.	24 Pdr Brass Howitzer.	2-8	10	3¾	·8	4-0	Not taken.	1000	,,	,,	,,	{ Time to 1st graze, did not burst, extinguished.
		2			,,	,,	3¾	·8	not obsd.			,,	20	on plane.	
		3			,,	,,	3¾	·8	4-0			,,	30	,,	Burst after grazing.
		4			,,	,,	3¾	·8	4-0			,,	60	10	
		5		,,	,,	,,	4	·8	4-0			,,	40	20	
		6		,,	,,	,,	3¾	·8	3-3			,,	60	8	
		7		,,	,,	,,	4	·8	4-1			,,	,,	,,	{ Time to 1st graze—did not burst, extinguished.
		8		,,	,,	,,	3¾	·8	3-3			,,	30	on plane.	
		9		,,	,,	,,	4¼	·8	4-1			,,	40	20	
		10		,,	,,	,,	4	·8	4-0			,,	20	on plane.	
		11		,,	,,	,,	4¼	·8	4-1			,,	25	20	
		12		,,	,,	,,	4	·8	4-2			,,	40	20	
		13		,,	,,	,,	4¼	·8	4-0			,,	25	on plane.	
		14		,,	,,	,,	4	·8	4-1			,,	30	5	
		15		,,	,,	,,	4¼	·8	4-0			at target.		30	
		16		,,	,,	,,	4	·8	4-0			,,	20	on plane.	
		17		,,	,,	,,	4¼	·8	4-1			,,	5	do.	
		18		,,	,,	,,	4	·8	4-1			,,	20	do.	
		19		,,	,,	,,	4	·8	4-1			,,	,,	,,	{ Time to 1 graze, did not burst shell found, Fuze out.
		20		,,	,,	,,	4	·8	4-1			,,	20	on plane.	

The Director General
of Artillery.

No. 2.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and Object of the Experiments. *Continuation of Practice from* 10 *Inch. Howitzer.*

Shoeburyness, 21*st May* 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and Weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	Barometer. Thermometer. Wind. Direction of Range. Distance between Targets. Size of Targets. Remarks.
Shell.	Fuze.											Short.	Beyond.		
			Ft. In.		lbs.oz.	lbs.oz.	Deg	Ins.	Seconds.	Ft. In	yds.	yds.	yds.	Feet.	
Common.	Large Cone.	21	15	10 In. Howitzer.	7	5-8	4	·7	5ths 4-0	not taken.		not obsd.		not obsd.	
		22			„	„	4	·7	4-0			do.		do.	
		23			„	„	4	·7	3-3			do.		do.	
		24			„										
		25													

Two Shells did not graze, the 24th and 25th Rounds not fired; The wood bottoms and straps the cause.

The Director General of Artillery.

No. 2.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and Object of the Experiments. *Continuation of Practice from 24 Pdr. Gun 56 Cwt.*

Shoeburyness, 21st May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and Weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	Remarks.
Shell.	Fuze.		Ft. In.		lbs.		Deg	Ins.	Seconds.	Ft. In.	yds.	Short. yds.	Beyond. yds.	Feet.	
									5ths						
Common.	Large Cone Fuze.	21	15 Feet.	24Pdr. 50Cwt	8	”	2½	·5	3-0	Not taken.	1000	”	10	8	
		22		”	”	”	2⅜	·5	3-0			”	10	5	
		23		”	”	”	2⅜	·5	3-0			”	10	10	
		24		”	”	”	2⅜	·5	3-1			”	20	20	
		25		”	”	”	2⅜	·5	not obsd.			at target.		30	

The Director General
of Artillery.

No. 2.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

NATURE AND OBJECT OF THE EXPERIMENTS. } *Continuation of Practice from 24 Pdr. Brass Howitzer.*

Shoeburyness, 21*st May* 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	REMARKS.
Shell.	Fuze.		Ft. In.		lbs.oz.	oz.	Deg	Ins.	Seconds. 5ths	Ft. In	yds.	Short. yds.	Beyond. yds.	Feet.	
Common Shell.	Large Cone Fuze	21	10 Feet.	24Pdr. Brass How-itzer.	2-8	10	4	·8	4-1	Not taken.	1000	„	5	20	
		22			„	„	4	·8	4-0			„	15	20	
		23			„	„	4	·8	3-3			„	10	5	Burst after grazing.
		24			„	„	4	·8	not obsd.			„	15	on plane.	
		25			„	„	4	·8	3-2			„	„	„	Did not burst, extinguished.

The Director General of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes and Fuze-holes.*

Shoeburyness, 23d May 1855.

Description of Shell.	Description of Fuze.	No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target. Short.	Burst from Target. Beyond.	Height of Burst above the Plane.	1stGraze of Shell.	Barometer 30° Thermometer 63° Wind S. S. West 5. Direction of Range S.E. × East Distance between Targets. Size of Targets. REMARKS.
			Ft. In.		lbs.oz.	lbs.	Deg	Ins.	Seconds.	Ft. In.	yds.	yds.	yds.	Feet.	yds.	
									5ths							
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	1	20 Feet.	10 In. Gun 85 cwt.	lbs. 12	5½	4⅜	1·0	5-0	Not taken.	1500	at target.		”	”	Burst on grazing.
		2					4⅜	1·0	5-0			do.		on plane	”	
		3					4⅜	1·0	5-0			do.		do.	”	
		4					4⅜	1·0	5 0			do.		do.	”	
		5					4½	1·0	5-0			do.		not obsd.	”	
		6					4⅝	1·0	5-1			”	50	20	”	
		7					4⅝	1·0	5-1			30	”	on plane	”	
		8					4⅝	1·0	5-2			not obsd.		do.	”	
		9					4⅝	1·0	5-0			40	”	do.	”	
		10					4⅝	1·0	5-0			”	”	”	1450	Did not burst, Time of flight given to 1st graze—Fuze extinguished.
		11	20 Feet.	10 In. Gun 85 cwt.	lbs. 12	5½	4½	1·0	5-2	Not taken.	1500	”	20	just after grazing.		24th May 1855.
		12					4½	1 0	5-1			50	”	10	”	
		13					4½	1·0	5-1			”	”	”	”	Did not burst—Fuze extinguished
		14					4½	1·0	”			”	”	”	”	Burst at the Muzzle,
		15					4½	1·0	5-0			”	1	on plane	”	
		16					4½	1·0	5-1			”	10	do.	”	
		17					4½	1·0	5-1			”	”	”	”	Did not burst—Shell found without its Fuze.
		18					4½	1·0	5-0			at target.		on plane	”	
		19					4½	1·0	5-0			do.		do.	”	
		20					4½	1·0	5-0			”	4	do.	”	

The Director General of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes and Fuze-hole.*

Shoeburyness, 23d *May* 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	1st graze of Shell	Barometer 30. Thermometer 63 Wind S. S. West 5. Direction of Range S.E. × East Distance between Targets. Size of Targets. Remarks.
Shell.	Fuze.		Ft. In.		lbs.oz.	oz.	Deg	Ins.	Seconds.	Ft.In.	yds.	Short. yds.	Beyond. yds.	Feet.	yds,	
Common Shells sent to Shoebury-ness 5th May 1855.	Large Cone Fuze.	1	12 Feet.	12 Pdr Brass How-itzer.	1-4	5	3½	·6	5ths not obsd.	Not taken.	900	,,	,,	,,	870	Did not burst Fuze extinguished.
		2					3½	·6	not correctly taken			not observed.			,,	
		3					3¾	·6	3-0			not obsd.		20	,,	Fuze acted but did not burst the shell.
		4					3¾	·6	3-4			601	,,	2	,,	do.
		5					4	·7	3-3			at target.		,,	,,	do.
		6					4	·7	3-2			do.		on plane	,,	
		7					4	·7	4-0			,,	20	do.	,,	
		8					4	·7	3-3			not obsd.		do.	,,	Fuze acted but did not burst the shell.
		9					4	·7	3-4			,,	10	do.	,,	do.
		10					4	·7	3-3			,,	20	do.	,,	do.
		11					3¾	·6	not obsd.			,,	,,	,,	,,	24th May 1855. Fuze acted but shell did not burst.
		12					3¾	·6	3-0			,,	,,	,,	,,	
		13					3¾	·7	4-2			not observed.			,,	Burst 2d graze-time to the Burst.
		14					3¾	·7	3-4			,,	,,	,,	,,	Fuze acted but shell did not burst.
		15					3¾	·7	3-4			,,	,,	,,	,,	do. do.
		16					3¾	·7	3-0			,,	,,	,,	,,	do. do.
		17					3¾	·7	4-0			,,	,,	,,	,,	Did not burst—Time to 1st Graze.
		18					3¾	·7	3-2			,,	,,	,,	,,	Fuze acted but shell did not burst.
		19					3¾	·7	3-2			,,	,,	,,	,,	do. do.
		20					3¾	·7	4-0			,,	,,	,,	,,	do. do.

The Director General of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

NATURE AND OBJECT OF THE EXPERIMENTS. } *To test the efficiency of Captain Boxer's Fuzes, and of an alteration which has been made in the angle of the cone of the Fuzes, and Fuze-hole.*

Shoeburyness 23d May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and Weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	1st graze of Shell	Barometer 30° Thermometer 63° Wind S. S. West 5. Direction of Range S.E × East Distance between Targets. Size of Targets. REMARKS.
Shell.	Fuze.		Ft. In.		lbs.	lb. oz.	Deg	Ins.	seconds.	Ft. In.	yds.	Short. yds.	Beyond. yds.	Feet.	yds.	
Common Shell sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	1	15 Feet.	8 Inch Howitzer.	4	2-4	3¾	·6	3-2	Not taken.	900	"	"	"	890	Did not burst, time to 1st graze Fuze extinguished.
		2					3¾	·6	3-1			"	"	"	860	do. do. do.
		3					4	·6	3-2			"	"	"	860	do. do. do.
		4					4	·6	3-2			30	"	10	"	
		5					4¼	·6	3-2			40	"	10	"	
		6					4¼	·6	3-3			not obsd.		20	"	
		7					4⅛	·6	3-3			20	"	20	"	
		8					4⅛	·6	not obsd.			short.	"	20	"	
		9					4⅛	·6	3-3			40	"	20	"	
		10					4⅛	·6	3-1			60	"	20	"	

The Director General of Artillery.

No. 2.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and Object of the Experiments. } *Continuation of Practice from* 10 *In. Gun* 85 *cwt.*

Shoeburyness 24*th May* 1855.

Description of												Bnrst from Target.			Barometer 30° Thermometer 65° Wind S. S. West 4. Direction of Range S.E. × East Distance between Targets. Size of Targets.
Shell.	Fuze.	No. of Rounds.	Height of Axis of Gun above the Plane. Ft. In.	Nature and Weight of Ordnance.	Charge. lbs.	Bursting Powder.	Elevation. Deg	Length of Fuze. Ins.	Time of Flight to Burst of Shell. seconds.	Recoil. Ft. In.	Range to Target. yds.	Short. yds.	Beyond. Feet.	Height of Burst above the Plane. Feet.	Remarks.
Common.	Large Cone Fuze.	21	15 Feet.	10 In. Gun 85 cwt.	lbs 12	lbs.oz. 5-8	4½	1·0	5ths 5-2	Not taken.	1500	"	"	"	Did not burst—Shell found without its Fuze.
		22					4½	1·0	5-1			close to	Target	on plane	
		23					4½	1·0	5-1			"	5	do.	
		24					4½	1·0	5-0			close to	Target	on plane	
		25					4½	1·0	"			"	"	"	Burst at the muzzle.

The Director General
of Artillery.

No. 1.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

NATURE AND OBJECT OF THE EXPERIMENTS. } *Continuation of Practice from* 12 *Pdr. Brass Howitzer.*

Shoeburyness, 24th May 1855.

Description of		No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and weight of Ordnance.	Charge.	Bursting Powder.	Elevation.	Length of Fuze.	Time of Flight to Burst of Shell.	Recoil.	Range to Target.	Burst from Target.		Height of Burst above the Plane.	Barometer 30. Thermometer 65. Wind S. S. West 4. Direction of Range S. E. × East. Distance between Targets. Size of Targets.
Shell.	Fuze.											Short.	Beyond.		REMARKS.
			Ft. In.		lb. oz.		Deg	Ins.	Seconds.	Ft. In.	yds.	yds.	yds.	Feet.	
									5ths						
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	21	12 Feet.	12 Pdr Howr.	lbs.oz. 1-4	oz. 5	3¾	·7	4-0	Not taken.	900	"	"	"	Did not burst.
		22					3⅝	·7	4-0			"	"	"	do.
		23					3⅝	·7	3-0			not observed.			Not ascertained.
		24					3⅝	·7	3-2			"	"	"	Fuze acted, but shell did not burst.
		25					3⅝	·7	3-3			"	"	"	do. do.
		26					3⅝	·7	4-0			not observed.			The shell burst.
		27					3⅝	·7	3-2			"	"	"	Fuze acted, but shell did not burst.
		28					4¼	·8	4-1			"	"	"	do. do.
		29					4¼	·8	4-0			not observed.			Burst at the graze.
		30					4¼	·8	4-0			"	"	"	Fuze acted, but shell did not burst.
		31					4¼	·8	4-1			not observed.			Not ascertained.
		32					4¼	·8	4-2			"	"	"	Fuze acted, but shell did not burst.
		33					4¼	·8	4-0			"	"	"	do. do.
		34					4½	·8	4-2			"	"	"	do. do.
		35					4½	·8	4-0			not observed.			Burst at grazing.
		36					4½	·8	4-1			Do.			do.
		37					3¾	·7	4-0			Do.			do.
		38					3¾	·7	3-4			"	"	"	Fuze acted, but shell did not burst.
		39					3¾	·7	4-0			"	"	"	do. do.
		40					3¾	·7	4-0			"	"	"	do do.

The Director General
of Artillery.

No. 3.

REPORT OF EXPERIMENTAL PRACTICE WITH COMMON SHELLS.

Nature and object of the Experiments. } *Continuation of Practice from 12 Pdr. Howitzer.*

Shoeburyness, 24th May 1855.

Description of Shell.	Description of Fuze.	No. of Rounds.	Height of Axis of Gun above the Plane. Ft. In.	Nature and Weight of Ordnance.	Charge. lbs.oz.	Bursting Powder. oz.	Elevation. Deg	Length of Fuze. Ins.	Time of flight to Burst of Shell. Seconds. 5ths	Recoil. Ft. In.	Range to Target. yds.	Burst from Target. Short. yds.	Burst from Target. Beyond. yds.	Height of Burst above the Plane. Feet.	Barometer 30° Thermometer 65° Wind S. S. West 4. Direction of Range S. E. × East. Distance between Targets· Size of Targets. REMARKS.
Common Shells sent to Shoeburyness 5th May 1855.	Large Cone Fuze.	41	12 Feet.	12 Pdr How-itzer.	lb. oz. 1-4	oz. 5	3¾	·7	4-0	Not taken.	900	„	„	„	Fuze acted, but shell did not burst.
		42					3¾	·7	4-0			„	„	„	do. do.
		43					3¾	·7	3-4			„	„	„	do. do.
		44					3¾	·7	3-3			„	„	„	do. do.
		45					3¾	·7	3-3			„	„	„	do. do.
		46					3¾	·7	4-0			„	„	„	do. do.
		47					3¾	·7	3-3			„	„	„	do. do.
		48					3¾	·7	3-3			„	„	„	do. do.
		49					3¾	·7	3-2			not observed.			Shell burst.
		50					3¾	·7	notobsd.			„	„	„	Fuze acted, but shell did not burst. The times are taken to the period of the Fuze acting, except where no burst was the case. The time of 1st graze is then given-a large number of these shells have been recovered. There is no doubt that the bursting powder is not sufficient to explode these shells with large Fuze-hole.

The Director General
of Artillery.

VIII. Mr. Martin's Shells filled with liquid fire.

MR. J. MARTIN.

Orchard Place, Blackwall, August 27th, 1855.

HONOURABLE GENTLEMEN,

According to your request on the 12th, when I had the honor of bringing before your notice my shell charged with fluid iron: I beg to state I have prepared 20 shots for the first experiment, the size of them is 7 inches and ⅞. I mention this gentlemen, in order that cannon of suitable size in bore may be in readiness. I am prepared to pay the expenses of the trial myself; perhaps gentlemen you will let the trial take place after dark, as it will afford an opportunity of witnessing the destructive effects of iron when in a fluid state.

Gentlemen, I shall require an order from you to allow the Furnace &c. which is necessary, to be placed upon Her Majesty's Range at Woolwich.

Gentlemen, In addition to the first experiment I have brought before you, I can cause a shell containing from 1 cwt. to 10 cwt. of fluid Iron, to explode over, or in a town at any given time, with perfect safety to those engaged in firing the gun.

Gentlemen, I am prepared to carry out the first experiment whenever you think proper to fix a time; as to the second, you will be able to judge from the effects of the first, whether or not the second is worthy of your notice.

The inventor is at the door awaiting your orders.

Orchard Place, Blackwall, August 31st, 1855.

Sir,

In answer to your letter of the 27th, where you state you were mistaken in the person, and could not find the name of Joseph Martin in your books, I beg to state I brought a letter from the Lord Panmure about the beginning of March last to the Board of Ordnance, respecting the firing of fluid iron, but I was then told it had been proposed before, on the first of May 1854.

Sir,—Hearing nothing of its merits, or of its being tried, and seeing the necessity in my own opinion of its being tried, I called on the twelfth and offered to try it at my own expense. I have frequently at my own factory at Blackwall, proved that it can be used against the enemy with the most destructive effects, and with the greatest safety used by ourselves.

Sir,—In my first letter to Lord Panmure, I mentioned that it would be necessary for the shell to strike some *object* previous to its bursting, or rather, to cause it to *burst*, but since then I have discovered the means to burst it in the air, at any given time, and with a charge of from one cwt. to 20 cwt. of iron in a fluid state.

Sir,—With your permission, I will bring before your notice one of my shells that has been filled with fluid iron, fastened up perfectly tight by means of an iron plug, so as to enable me to withdraw it, and shew what state the iron will be in 5 minutes after the pouring it in.

Sir,—The second specimen will be that of a shell filled with fluid iron, there will be a coating formed of a substance, the preparation of which is known to no one but myself, which acts as a non-conductor of heat as well as cold; but not being able to convey to you an idea by drawings, I propose to bring the shells in three stages of their advancement towards the desired object.

Sir,—I shall be very glad to answer any questions, and give any, or every explanation you may require from me, and I beg to state, I wish to abide by the printed rules and regulations of the Ordnance Department.

Yours obediently,

(Signed) Joseph Martin.

Marshes Woolwich, 1*st April* 1856.

EXPERIMENTAL PRACTICE WITH MR. MARTIN'S SHELLS FILLED WITH LIQUID IRON.

68 Pdr. 95 Cwt. Iron Gun placed at 600 yds. from the Bulk Heads Marshes.

Members Present.

Captain CAFFIN, C. B. R. N.
Colonel COLE, R. E.
Colonel TULLOH, R. A.
Lieut. Colonel EARDLEY WILMOT, R. A.
Captain YOUNGHUSBAND, R. A. F. R. S.
Professor WHEATSTONE, F. R. S.
F. A. ABEL Esquire.
J. ANDERSON Esquire.

The shells were guaged, the highest filled with metal.

Diameter of shell empty	7·87	inches.
,, one minute after filling	7·88	,,
,, 8 minutes after filling	7·885—·015 expander.	

The wood bottom of shell commenced charring three minutes after shell being filled ; shell bottom in flames in 15 minutes. One hour after, paper immediately ignited on being placed in contact. Diameter of shell one hour after being filled 7·95 shewing expansion of ·08 inches. This shell was fired see 5th round.

Rounds.	Charge.	Elevation.	REMARKS.
1	6	$1\frac{3}{8}$°	At the Masonry, struck, breaking to pieces, portion (Specimen No. 1) flattened and found sticking to the granite.
2	8	$1\frac{3}{8}$°	At Wood Bulkhead, struck passing through, smoke observed coming from Bulkhead immediately, portions of this and No. 4 shell (Specimens No. 2), and small pieces of the well scattered metal (Specimens No. 3)
3	8	$1\frac{7}{16}$°	At Wood Bulkhead, missed, passing over close above, entering butt.

Rounds	Charge.	Elevation.	REMARKS.
4	8	$1\frac{7}{16}$°	At Wood Bulkhead, struck, passing through, molten iron shewing a broad glare as it entered the butt.
5	8	$1\frac{7}{16}$°	At Bulkhead, grazed in front of Bulkhead, then passed through, this shell had the metal poured in one hour before it was fired (See guaging) this shell had been rolled about and moved several times, but its shape was found unaltered, before it was placed in the Gun.
6	8	$1\frac{7}{16}$°	At Bulkhead, passing through it, shewing the molten iron in flakes after the breaking of the shell.
7	8	$1\frac{7}{16}$°	At Bulkhead, struck, breaking, scattering a stream of burning metal, smoke observed issuing from the Bulkhead. This shell was not placed in the gun until 2 minutes after being filled, the flag was then lowered, a vessel being in the range, and another 1½ minute elapsed before the gun was fired.
8	8	$1\frac{7}{16}$°	At Bulkhead, struck, smoke observed issuing densely from Bulkhead immediately after the shell entered. Shell in two parts, recovered (Specimens No. 4.) This shell was not fired until 6 minutes after being filled, the object of this delay was, that the metal might consolidate and disperse in larger fragments than those shewn in Specimens No. 3. A mistake as to fragments is here made, the fragments numbered 4, are not those of this round, but No. 5 round, the shell that was kept one hour before being fired.
9	8	$1\frac{7}{16}$°	At Bulkhead. Fired four minutes after being filled, struck, passed through Bulkhead, shell breaking, denser masses seen to issue immediately after of white smoke. A few minutes after, the Bulkhead broke out into flames from every part where these shells entered.
10	8	$1\frac{7}{16}$°	At the Masonry, struck, the dispersion of the molten iron plainly seen, recovered some portions (Specimens No. 5) this shell was fired 5 minutes after being filled.
11	10	1°	At the Masonry, struck, the dispersion of the metal very plainly seen. This shell was 14 minutes in the gun before being fired, recovered portions (Specimens No. 6) (Specimens No. 7) Fragments of the several shells.

There was no difficulty experienced in charging these shells, in no instance was there any spirting of the metal, the shells were safely lifted up by the aid of a piece of cotton and placed in the gun, 2 and 3 minutes after being filled.

Report of B. Sub Committee on Experiments made with the shells filled with liquid iron, proposed by Mr. Joseph Martin, Blackwall.

The shells furnished by Mr. Martin for the experiment were twelve in number, they were of the proper diameter for an eight inch gun, and were stated by Mr. Martin to be of unequal thickness, the part to be placed nearest the charge, being of greater substance than the remainder. The openings in the shells were slightly conical, and provided with plugs fitting loosely. The shells were provided with bottoms in the Laboratory.

The liquid iron was prepared in a portable cupola at a distance of about fifty yards from the gun. The shells were filled with the molten metal by means of a day funnel, contrived by Mr. Martin; when full, a small quantity of baked sand was thrown into the opening so as to cover the small exposed surface of metal, the plugs were then inserted into the shells.

The charged shells were placed in the gun without difficulty, even 5 minutes after the liquid metal had been introduced. A stout cotton cloth was the only thing used to protect the hands, in lifting the shells.

The following conclusions may be drawn from an examination of the subjoined tabulated results of the experiments.

1st That, provided the liquid iron can be readily obtained, there is no practical difficulty attending the filling of the shells, as proposed by Mr. Martin, with the molten metal, or their introduction into the gun.

2d That the iron in the shell retains a liquid, or pasty form for some considerable time after the shell has been filled, and that the degree to which the iron is divided and scattered upon the fracture of the shell, (and, consequently, the effect produced by the use of these shells) may be regulated by the period that is allowed to elapse between the filling of the shell, and its discharge from the gun.

3d That, even, with moderate charges, the concussion of Mr. Martin's shell against stout wood work is sufficient to effect its fracture, and the dispersion of the metallic contents ; and that this may be the case, even when the metal is allowed to solidify completely, before the shell is fired.

4th That, if the charge of iron be allowed to solidify in the shell, and, even if a very considerable time (about one hour) be allowed to elapse, before the shell is fired, it will be found similarly effective to a red hot shot.

The Sub Committee consider the practicability of Mr. Martin's proposal, and the efficacy of the non conducting material used to coat the interior of his shells, to have been fully established by the experiments made; they believe however, that farther and systematic experiments must be made, in order to determine the extent to which the use of shells filled with liquid iron, might prove valuable to the service.

IX. Description of a Target by Captain. C. H. Hutchinson Madras Artillery.

The Target used for trial of small arms and ammunition, from which the diagrams of rifle practice have been taken, deserves description. It is of cast iron, and is made up of six rectangular pieces or plates, cast with flanges for the insertion of screw bolts and nuts, by which they are firmly united into a twelve feet square surface. Supported by a frame and mounted upon four wheels, it runs upon rails laid in front of the butt; and is easily moved aside when other targets are to be used.

The face, painted white, is divided into squares of 6 inches, by lines scored into the iron and filled in with black paint;

stronger black lines along the junctions of the plates further divide the surface into six equal parts, by which the exact position of any one of the smaller squares in which a bullet strikes is readily distinguished, and the spot noted upon a diagram, or miniature copy of the dividing lines and squares on the face of the target. With a good telescope at ordinary distances, every shot can be noted by the firing party; and a marker is not required to be posted near the target.

X. Experiments with Wooden Plugs for Rifle balls.

March 6th, 1856. Tried the penetration of No. 3 ball against wood plug at 50 yards—ball from the same die and catridges filled with same powder.

1st round	No. 3, through	11—½ inch boards	and struck 12th
1st ,,	Wood plug	do.	do.
2nd ,,	No. 3	do.	do.
2nd ,,	Wood plug	do.	do.
3rd ,,	No. 3	do.	do.
3rd ,,	Wood plug	10.	11.
4th ,,	No. 3	10.	11.
4th ,,	Wood plug	10.	did not strike 11.
5th ,,	No. 3	10.	11.
5th ,,	Wood plug	19.	did not strike 11.

March 6th, 1856. Commenced with No. 3 ball—the bullets were from the same die, the cartridges filled with the same powder, result in favor of No. 3. See Diagram.

March 7th, 1856. Fired alternately, commencing with wood plug, only 22 rounds from each, part of the stand having given way, result in favor of No. 3. See Diagram.

March 8th, 1856. 100 rounds fired, fouled 64th round, rammed down paper twice, and cleaned to the 100th,—6 or 7 Cartridges not as carefully made as they should be, filled loose and powder down the sides.

March 10th, 1856. Balls from same die, cartridges filled with same powder, fired alternately, both Ammunition behaved very well until the 26th round, when both threw wider, the rifle not being the least foul, except a little at the breech, the wood plug missed three times in the 40 rounds, again giving the result in favor of No. 3 before the wide shooting; if a difference could be discerned, No. 3 was the best target. See Diagrams.

March 17th, 1856. Commenced the manufacture of the wood plug ammuniton on this day.

March 19th 1856. The bullets were from the same die, the cartridges filled with the same powder, the ammunition fired under similar circumstances as to Rifle and direction, the rest not being altered the whole day, but the plug had the advantages as to temperature and amount of wind; the 3 ball was fired first, during the hot part of the day, the shooting on account of the misses in the second hundred of the No. 3 is in favor of the wood plug, the No. 3 however having given the closest targets. See Diagram.

March 20th 1856. Fired 100 rounds to try loading, 1 strip, the cartridges cleaned and better, but still not so good as they should be.

April 4th 1856. Balls from the same die, cartridges filled with same powder—fired in lots of 10 alternately—shooting in favor of No. 9. See Diagram.

April 7th 1856. Fired 100 rounds of each, ·566 diameter, the firing of No. 9 was not satisfactory, that of the wood plug very much so. See Diagram.

April 9th 1856. Wood plug got the better of No. 9, diameter of ball ·566 again; see Diagram. No. 9 did not appear to strip.

April 14th 1856. It was blowing very hard and the wind crossing wood plug gave 5 misses, but it seemes probable that it was not owing to the ammunition but to the wind, as the shots all rounded well. No. 9 made two misses, the stand was shifted to meet the wind.

Note·—The Diagrams referred to in the above article have not been received

No. 1. REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT.	*To ascertain Ranges and Deflections with Lead and Plugged shell, from* 10 *Inch Howitzer* 125 *Cwt. and also the action on the Trunnion holes lined with vulcanized India Rubber.*

Shoeburyness, 9*th November* 1854.

No. of Rounds.	Height of Axis of Gun above the Plane. ft. in.	Nature and Weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. sec.	Recoil. ft.in	1st Graze. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Barometer 30·125. Thermometer 53° Wind—N. West 5. Direction of Range E. × ½ South. REMARKS.
1	20 Feet.	10 In. Howitzer 125 Cwt.	16·0	30	25$\frac{45}{60}$	0·3	4800	....	120	lbs ozs. Weight of shot 140-11
2			16·0	30	not seen.	0·8½	4900	....	350	do. 140- 0
3			16·0	42	34$\frac{30}{60}$	0·6½	5150	....	250	do. 140- 2
*4			16·0	42	34$\frac{30}{60}$	0·8½	5000	300	....	do. 139-11
5			16·0	16$\frac{15}{60}$	17	1·4	3700	....	70	do. 97-11

Elevation by Quadrant.

Given range 4500 yards at which distance a Target 9 ft. × 9 ft. was placed.

N. B. The India Rubber appeared slightly lengthened upwards, owing to compression, but otherwise relieved the strain on the Brackets.

(Signed) RICHARD G. WILSON,
Lieut. Col. Royal Artillery.

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* This round was laid to the left to overcome the deflection occasioned by the wind, but the wind whilst the shot was in flight suddenly fell.

The Director General
of Artillery.

No. 2. REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. *To ascertain Ranges and Deflections with Lead and Plugged shells, fired from* 10 *Inch Howitzer* 125 *Cwt. and also the action on the Trunnion holes of Carriage lined with vulcanized India Rubber.*

Shoeburyness 24*th November* 1854.

Barometer 29·25.
Thermometer 53°
Wind S. West 4.
Direction of Range E. × ½ South.

Weight of shot. lbs.oz.	No. of Rounds.	Height of Axis of Gun above the Plane. Ft. In	Nature & weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg.	Time of Flight. Sec.	Recoil. Ft. In.	1st Graze. yds.	Deflection. Left. yds	Deflection. Right. yds	Remarks.
97-11	1	15 Feet.	10 Inch Iron Howitzer 125 Cwt.	16 lbs.	$16\frac{15}{60}$	17	1-4	3700	..	70	This round was returned in report of the 9th Nov. the bed was then on the terreplein.
97-13	2				$16\frac{45}{60}$	$16\frac{30}{60}$	0-2	3420	..	44	Fired 24th Nov. Bed rested in sand.
97- 3	3				$16\frac{30}{60}$	16	0-2	3210	..	64	
97- 3	4				$16\frac{30}{60}$	$16\frac{45}{60}$	0-2	3456	..	94	
97- 4	5				16	$16\frac{50}{60}$	0-2	3475	30	..	
97-12	6				16	$16\frac{15}{60}$	0-2	3350	..	24	
97-11	7				16	16	0-2	3225	10	..	
97- 9	8				16	$16\frac{15}{60}$	0-2	3325	..	4	
97-13	9				16	$16\frac{15}{60}$	0-2	3340	..	68	
97- 8	10				16	$16\frac{55}{60}$	0-2	3525	80	..	
140-11	11			16 lbs.	30	$25\frac{45}{60}$	0-3	4800	..	120	These two rounds were returned in report of the 9th Nov. the bed was then on the terreplein.
140- 0	12				30	Graze not seen from Battery.	0-8½	4900	..	350	
97-12	13				30	29	0-6	5100	251	..	Fired 15th Nov. 1854. Bed was on the terreplein The Carriage wheeled to the right on its pivot.
97-14	14				30	30	1-2	5150	360	..	
97- 9	15				30	28	1-3	4900	..	435	
97- 2	16				30	29	0-6	4650	..	13	Fired 17th Nov. Bed rested in sand.
97-11	17				30	29	0-4	4600	..	200	
97- 7	18				30	29	0-3	4600	..	175	
97- 6	19				30	$29\frac{30}{60}$	0-3	4700	..	13	
97-10	20				$31\frac{15}{60}$	Graze not seen from Battery.	0-2	4450	..	148	
97- 9	21				$31\frac{5}{60}$	Do.	0-2	4500	475	..	
97-10	22				$31\frac{5}{50}$	29	0-2	4600	..	216	
139-14	23				$31\frac{5}{60}$	27	0-2	4400	..	168	
141- 6	24			12 lbs.	$31\frac{5}{60}$	29	0-2	4600	133	..	
141- 0	25				$31\frac{5}{60}$	29	0-2	4650	..	38	
97- 2	26			16 lbs.	35	Graze not seen from Battery.	0-2	4760	..	530	Fired 22nd Nov. Bed rested in sand.
97- 4	27				35	Do.	0-2	4775	..	658	
140- 0	28				35	Do.	0-2	5100	..	150	
140-10	29				35	29	0-2	5250	..	386	
140-10	30			12 lbs.	35	29	0-2	5230	54	..	
97-14	31			16 lbs.	35	$27\frac{30}{60}$	0-2	5125	..	3	
140- 2	32			16 lbs.	42	$34\frac{30}{60}$	0-6⅓	5150	..	250	These rounds returned in report of 9th Nov. Bed was then on the terreplein
139-11	33				42	$34\frac{30}{60}$	0-8½	5000	300	..	
97- 9	34				42	Graze not seen from Battery.	0-2	4750	..	472	Bed wheeled over to right but was corrected the subsequent round.
97- 8	35				42		0-2	4550	276	..	Fired 24th Nov.
97-12	36				42	30	0-2	4450	100	..	
97- 8	37				42	31	0-2	4525	120	..	
97-12	38				42	30	0-2	4440	8	..	
97- 4	39				42	30	0-2	4440	206	..	
97- 8	40				42	$30\frac{15}{60}$	0-2	4470	48	..	

No effect upon the Carriage.

N. B. The wind on the 15th November was S. W. 4.
do. 17th ,, was N. E. 5.

(Signed) Richard G. Wilson, *Lieut. Col. Royal Artillery.*

The Director General
of Artillery.

EXPERIMENTS WITH VARIOUS FOREIGN POWDERS IN COMPARISON WITH WALTHAM ABBEY POWDER, MEAN OF THREE ROUNDS, FROM 32 Pdr. 58 Cwt. GUN.

Mean Diameter of shot.	Charge.		Elevation.	Wettern Barrel No. 4.	Claremont Barrel No. 4.	Prussian Barrel No. 9.	Waltham Abbey.	Remarks.
	lbs.	oz.	Deg.	yds.	yds.	yds.	yds.	lbs. oz. drs.
6·169	10	0	2	1278	1285	1216	1258	Weight of shot 31-12- 0
6·17	10	0	5	1898	1950	1907	1962	
6·16	10	0	10	2768	2558	2491	2701	Do. 31- 1- 0

EXPERIMENTS WITH VARIOUS FOREIGN POWDERS IN COMPARISON WITH WALTHAM ABBEY POWDER, MEAN OF THREE ROUNDS, FROM 32 Pdr. 58 Cwt. IRON GUN

Mean Diameter of shot.	Charge.		Elevation.	Dupont.	Ombert.	Loome's.	Hazard.	Waltham Abbey.	Remarks.
	lbs.	oz.	Deg.	yds.	yds.	yds.	yds.	yds.	
6·16	10	0	5°	1963	1857	1860	1951	1962	

EXPERIMENTS WITH VARIOUS FOREIGN POWDERS IN COMPARISON WITH WALTHAM ABBEY POWDER, MEAN OF 3 ROUNDS, FROM 8 INCH GOMER MORTAR.

Charge.		Wettern Barrel No. 1.	Dupont.	Claremont Barrel No. 4.	Ombert.	Hazard's.	Loome's.	Prussian Barrel No. 9.	Waltham Abbey.	Remarks.
lbs.	oz.	yds.	yds.	yds.	yds.	yds.	yds.	yds.	yds.	lbs. oz. drs.
...	2	64	71	64	59	82	78	54	91	Shot weight 67 15 12
...	4	116	137	124	113	162	143	102	148	
...	6	124	155	135	145	235	222	134	211	Do. 67 15 9
...	8	243	300	226	242	338	309	187	275	

EXPERIMENTS WITH VARIOUS FOREIGN POWDERS IN COMPARISON WITH WALTHAM ABBEY POWDER, MEAN OF 3 ROUNDS FROM 13 L. S. MORTAR.

Weight of shell	Elevation.	Charge.		Wettern Barrel No. 1.	Claremont Barrel. No. 4.	Prussian Barrel No. 9.	Waltham Abbey.	Remarks.
lbs.	Deg.	lbs.	oz.	yds.	yds.	yds.	yds.	
202	45-20	9	0	2647	2911	......	......	
202	44-45	9	0	......	......	2632	2537	The angle of elevation was altered in consequence of the sinking of the wood of the Mortar bolster. Wood Plugs in shell, cut off flush.

EXPERIMENTS WITH VARIOUS FOREIGN POWDERS IN COMPARISON WITH WALTHAM ABBEY POWDER, MEAN OF 3 ROUNDS FROM 13 INCH SEA SERVICE MORTAR.

Charge.		Wettern.	Claremont.	Prussian.	Waltham Abbey.	Remarks.
lbs.	oz.					
20	0	3952	3830	3355	4037	Shells plugged; weighted with sand to 202 lbs.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *To ascertain the relative strength of various kinds of Powder.*

Shoeburyness, 29th February **1856.**

Deseription of Powder used.	No. of Rounds.	Height of Axis of piece above the plane. Ft. In.	Nature and weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. ft. in	Range. yds.	Deflection. Left. feet.	Deflection. Right. feet.	Barometer 30·375 Thermometer 58° Wind S. S. E. 2. Direction of Range. REMARKS.
Wettern Barrel No. 1.	1	12-0	8 Inch Gomer Mortar	0-4	45	Not taken.	Not taken.	110	7½	..	
	2	,,		,,	,,			105	In line		
	3	,,	,,	,,	,,			122	11	..	
Dupont.	4	,,	,,	,,	,,			140	3½	..	
	5	,,	,,	,,	,,			134	8	..	
	6	,,	,,	,,	,,			137	10	..	
Claremont Barrel No. 4.	7	,,	,,	,,	,,			129	4	..	1st March { Wind N. N. E. 5
	8	,,	,,	,,	,,			140	6	..	
	9	,,	,,	,,	,,			102	2	..	
Omberts.	10	,,	,,	,,	,,			103	..	5	
	11	,,	,,	,,	,,			117	..	1	
	12	,,	,,	,,	,,			119	In line		
Hazards.	13	,,	,,	,,	,,			163	6	..	
	14	,,	,,	,,	,,			160	..	4	
	15	,,	,,	,,	,,			162	5	..	
Loomes.	16	,,	,,	,,	,,			131	2	..	
	17	,,	,,	,,	,,			172	1	..	
	18	,,	,,	,,	,,			126	1	..	
Prussian Barrel No. 9.	19	,,	,,	,,	,,			94	1	..	
	20	,,	,,	,,	,,			104	In line		
	21	,,	,,	,,	,,			108	..	½	
Wettern Barrel No. 1.	22	,,	,,	0-6	,,			123	14	..	3d March { Wind N. N. W. 2
	23	,,	,,	,,	,,			129	2	..	
	24	,,	,,	,,	,,			119	..	2½	
Dupont.	25	,,	,,	,,	,,			173	In line		
	26	,,	,,	,,	,,			140	11	..	
	27	,,	,,	,,	,,			153	..	1	

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *Continuation of Practice with various kinds of Powder.*

Shoeburyness, 3d March 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Piece above the plane.	Nature and weight of Ordnance.	Charge.	Elevation.	Time of Flight.	Recoil.	Range.	Deflection.		Barometer 30·218. Thermometer 54° Wind N. N. West 2. Direction of Range. REMARKS.
		Ft. In.		lbs.oz.	Deg	Sec.	ft.in	yds.	Left. feet.	Right. feet.	
Claremont Barrel No. 4	28	12-0	8 Inch Gomer Mortar.	0-6	45	Not taken.	Not taken.	133	4	..	
	29	,,		,,	,,			123	..	1	
	30	,,	,,	,,	,,			149	3	..	
Ombert.	31	,,	,,	,,	,,			119	..	2	
	32	,,	,,	,,	,,			144	1	..	
	33	,,	,,	,,	,,			173	..	1	
Hazards.	34	,,	,,	,,	,,			229	3½	..	
	35	,,	,,	,,	,,			247	In line.		
	36	,,	,,	,,	,,			230	..	12	
Loomes.	37	,,	,,	,,	,,			212	13	..	4th March { Wind N. N. W. 2
	38	,,	,,	,,	,,			226	..	7	
	39	,,	,,	,,	,,			230	11	..	
Prussian Barrel No. 9	40	,,	,,	,,	,,			136	..	6	
	41	,,	,,	,,	,,			150	..	½	
	42	,,	,,	,,	,,			115	In line.		
Wettern Barrel No. 1	43	,,	,,	0-8	,,			230	7	..	
	44	,,	,,	,,	,,			258	..	13	
	45	,,	,,	,,	,,			240	..	6	
Dupont.	46	,,	,,	,,	,,			323	..	10	
	47	,,	,,	,,	,,			294	4	..	5th March { Wind 0 (Calm.)
	48	,,	,,	,,	,,			283	..	5	
Claremont Barrel No. 4	49	,,	,,	,,	,,			220	..	2½	
	50	,,	,,	,,	,,			233	..	6	
	51	,,	,,	,,	,,			226	In line.		
Ombert.	52	,,	,,	,,	,,			249	6	..	
	53	,,	,,	,,	,,			234	..	4	
	54	,,	,,	,,	,,			242	8	..	

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *Continuation of Practice with various kinds of Powder.*

***Shoeburyness, 5th March* 1856.**

Description of Powder used.	No. of Rounds.	Height of Axis of Piece above the plane. Ft. In.	Nature and Weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. ft.in	Range. yds.	Deflection. Left. feet.	Deflection. Right. feet.	Barometer 30·125. Thermometer 53° Wind 0 (Calm.) Direction of Range. REMARKS.
Hazards.	55	12-0	8 Inch Gomer Mortar	0-8	45	Not taken.	Not taken.	338	18		
	56	„		„	„			340	6		
	57	„	„	„	„			337	15		
Loomes.	58	„	„	„	„			296	..		
	59	„	„	„	„			318	7		
	60	„	„	„	„			312	..		
Prussian Barrel No. 9	61	„	„	„	„			190	..		
	62	„	„	„	„			182	3		
	63	„	„	„	„			190	In line.		
Wettern Barrel No. 1	64	„	„	0-2	„			59	1		4th March.
	65	„	„	„	„			72	..		
	66	„	„	„	„			61	1		
Dupont.	67	„	„	„	„			63	In line.		
	68	„	„	„	„			83	1		5th March.
	69	„	„	„	„			68	In line.		
Claremont Barrel No. 4	70	„	„	„	„			64	2		
	71	„	„	„	„			63	3		
	72	„	„	„	„			66	4		
Ombert.	73	„	„	„	„			62	½		
	74	„	„	„	„			55	2		
	75	„	„	„	„			59	1		
Hazards.	76	„	„	„	„			81	1		
	77	„	„	„	„			80	..		
	78	„	„	„	„			84	4		
Loomes.	79	„	„	„	„			80	3		
	80	„	„	„	„			77	In line.		
	81	„	„	„	„			77	In line.		

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *Continuation of Practice with various kinds of Powder.*

Shoeburyness 5th March 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Piece above the plane. Ft. In.	Nature and Weight of Ordnance.	Charge. lbs. oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. ft. in	Range. yds.	Deflection.		Barometer 30·125. Thermometer 53.° Wind 0 (Calm.) Direction of Range. REMARKS.
									Left. feet.	Right. feet.	
Prussian Barrel No. 9	82	12-0	8 Inch Gomer Mortar	0-2	45	Not taken.	Not taken.	58	3	..	
	83	,,		,,	,,			52	2	..	
	84	,,	,,	,,	,,			51	..	1	
Waltham Abby 11th January 1856, marked 29½ on the Barrel.	85	,,	,,	,,	,,			89	..	2	15th March { Wind E. S. E. 6
	86	,,	,,	,,	,,			90	..	5	
	87	,,	,,	,,	,,			94	..	6	
	88	,,	,,	0-4	,,			158	2	..	
	89	,,	,,	,,	,,			147	4	..	
	90	,,	,,	,,	,,			139	7	..	
	91	,,	,,	0-6	,,			194	..	1	
	92	,,	,,	,,	,,			230	..	10	
	93	,,	,,	,,	,,			210	..	14	
	94	,,	,,	0-8	,,			290	15	..	
	95	,,	,,	,,	,,			240	..	4	
	96	,,	,,	,,	,,			295	..	20	

	lbs.	oz.	drs.
The shot fired with 2 oz. Charges, weighed	67	15	12
Do. with all other Charges ,,	67	15	9

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. *To ascertain the relative strength of various kinds of Powder.*

Shoeburyness 6th March 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Gun above the Plane.	Nature and Weight of Ordnance.	Charge.	Elevation.	Time of Flight.	Recoil.	1st Graze.	Deflection.		Diameter of shot.	Barometer 30·112. Thermometer 52.° Wind N. N. West 4. Direction of Range E. × ½ South. REMARKS.
		ft. in		lbs. oz	Deg	Sec. 5ths	ft. in	yds.	Left. feet.	Right. feet.		
Wettern Barrel No. 1	1	12-0	32 Pdr. Gun 58 Cwt	10-0	2	4-0	8-2	1310	..	8	6·17	
	2	,,	,,	,,	,,	4-0	8-3	1298	..	10	6·17	
	3	,,	,,	,,	,,	3-4	8-0	1227	3	..	6·16	
Claremont Barrel No. 4	4	,,	,,	,,	,,	not obsd.	7-9	1240	..	11	6·17	
	5	,,	,,	,,	,,	3-3	7-11	1252	..	14	6·17	
	6	,,	,,	,,	,,	not obsd.	7-11	1362	..	16	6·16	
Prussian Barrel No. 4	7	,,	,,	,,	,,	3-2	7-9	1224	..	1	6·17	
	8	,,	,,	,,	,,	3-3	7-0	1238	..	20	6·17	
	9	,,	,,	,,	,,	3-1	7-7	1185	..	12	6·16	
Waltham Abbey	10	,,	,,	,,	,,	not obsd.	8-6	1248	yds. ..	yds. 6	6·17	15th March Wind E.S E. 6
	11	,,	,,	,,	,,	4-0	9-0	1326	..	5	6·17	
	12	,,	,,	,,	,,	not obsd.	8-8	1200	3	..	6·17	
Wettern Barrel No. 1	13	,,	,,	,,	5		9-0	1842	..	7	6·17	
	14	,,	,,	,,	,,	7-0	8-7	1901	..	1	6·17	
	15	,,	,,	,,	,,	7-0	9-0	1950	19	..	6·17	
Claremont Barrel No 4	16	,,	,,	,,	,,	7-1	8-7	2024	9	..	6·17	
	17	,,	,,	,,	,,	6-3	8-6	1872	13	..	6·17	
	18	,,	,,	,,	,,	7-0	8-7	1953	..	14	6·17	
Prussian Barrel No. 9	19	,,	,,	,,	,,	7-0	8-4	1898	..	11	6·17	
	20	,,	,,	,,	,,	7-3	7-9	2011	..	8	6·17	
	21	,,	,,	,,	,,	6-4	7-6	1812	..	4	6·17	
Waltham Abbey	22	,,	,,	,,	,,	7-1	9-0	2011	..	18	6·17	
	23	,,	,,	,,	,,	7-0	8-9	1925	..	21	6·17	
	24	,,	,,	,,	,,	7-0	8-7	1950	..	6	6·17	
Wettern Barrel No. 2	25	,,	,,	,,	10	12-1	7-6	2780	..	51	6·16	
	26	,,	,,	,,	,,	12-0	7-8	2800	..	81	6·16	
	27	,,	,,	,,	,,	11-3	7-11	2725	..	23	6·16	

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. } *To ascertain the relative strength of various kinds of Powder.*

Shoeburyness 12*th March* 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Piece above the plane F. I.	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight. Sec.	Recoil. ft.in	Range. yds.	Deflection.		Barometer 30. Thermometer 46.° Wind N. East 7. Direction of Range. { Between the shot and shell ranges
									Left. yds.	Right. yds.	Remarks.
Wettern Barrel No. 1	1	about 11-0	13 In. Land Service Mortar	9-0	45-20	Not taken.	,,	2644	53	,,	
	2	,,		,,	,,		,,	2650	,,	169	
	3	,,		,,	,,		,,	2648	,,	19	
Claremont Barrel No. 4	4	,,	,,	,,	,,		,,	2889	,,	151	
	5	,,	,,	,,	,,		,,	2885	,,	88	
	6	,,	,,	,,	,,		,,	2958	,,	121	
Prussian Barrel No. 9	7	,,	,,	,,	44-45		,,	2689	,,	56	
	8	,,	,,	,,	,,		,,	2508	,,	67	
	9	,,	,,	,,	,,		,,	2700	,,	67	
Waltham Abbey	10	,,	,,	,,	,,		,,	2540	,,	91	Waltham Abbey Powder.
	11	,,	,,	,,	,,		,,	2572	,,	40	11th January 1856.
	12	,,	,,	,,	,,		,,	2500	,,	136	29½ marked on the barral.

Shells plugged, filled with sand, and weighted to 202 lbs. The Plugs cut off flush.

The Mortar was adjusted as accurately as possible, at the first 6 rounds—the angle as taken by the Quadrant was 45-20 ; from the 7th to 12th rounds in consequence of a slight sinking of the wood of the bolster, the angle for the remainder was 44·45,

The platform was quite level.

The Director General
of Arlillery.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *Continuation of Practice with various kinds of Powder.*

Shoeburyness, 15*th March* 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Gun above the plane. F. I.	Nature and Weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. Sec 5th	Recoil. ft.in	1st Graze. yds.	Deflection.		Diameter of shot.	Barometer 30·136. Thermometer 45° Wind E. S. East 6 Direction of range E. × ½ South. REMARKS.
									Left. yds.	Right. yds.		
Claremont Barrel No. 5	28	12-0	32 Pdr. Gun 58 Cwt	10-0	10	11-0	7-0	2580	,,	19	6·16	
	29	,,		,,	,,	11-1	6-10	2620	15	,,	6·16	
	30	,,	,,	,,	,,	10-1	7-0	2475	33	,,	6·16	
Prussian Barrel No. 10	31	,,	,,	,,	,,	11-0	5-6	2440	,,	12	6·16	
	32	,,	,,	,,	,,	11-0	6-0	2558	,,	57	6·16	
	33	,,	,,	,,	,,	11-1	6-3	2475	12	,,	6·16	
Waltham Abbey.	34	,,	,,	,,	,,	11-1	8-0	2640	25	,,	6·16	
	35	,,	,,	,,	,,	12-0	8-0	2794	,,	27	6·16	
	36	,,	,,	,,	,,	11-1	8-0	2670	,,	12	6·16	

Elevation throughout by Quadrant.

Gun mounted on a ship carriage with wooden trucks.
Slope of Platform 3°

	lbs.	oz.	drs.
The shot fired from 2° to 5° inclusive weighed	31	12	0
Those fired at 10°	31	1	0

Note. The Waltham abbey Powder used for this practice was from Barrel marked 29½—11th January 1856.

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. } *To ascertain the relative strength of various kinds of Powder.*

Shoeburyness, 17*th March* 1856.

Description of Powder used.	No. of Rounds.	Height of Axis of Gun above the plane. F. I.	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight. Sec.	Recoil. ft.in	1st Graze. yds.	Deflection.		Diameter of Shot.	Barometer 30. Thermometer 50° Wind E. S. East 5. Direction of Range E. × ½ S. REMARKS.
									Left. yds.	Right. yds.		
Dupont.	37	12-0	32 Pdr. Gun 58 Cwt.	10-0	5	The Weather would not admit of the time of Flight being taken.	6-3	1940	15	„	6·16	A quantity of Saltpetre at each discharge shewed at the vent.
	38	„		„	„		7-4	1900	11	„		
	39	„		„	„		7-6	2050	27	„		
Ombert.	40	„	„	„	„		7-8	1850	„	11		
	41	„	„	„	„		7-10	1865	12	„		
	42	„	„	„	„		8-0	1856	9	„		
Loomes.	43	„	„	„	„		8-9	1885	12	„		
	44	„	„	„	„		8-6	1860	6	„		
	45	„	„	„	„		9-0	1835	18	„		
Hazards.	46	„	„	„	„		8-10	1884	„	4		
	47	„	„	„	„		9-4	2025	30	„		
	48	„	„	„	„		8-10	1945	„	6		

Elevation by Quadrant

Gun mounted on a ship carriage with wooden Trucks.

Slope of Platform 3°

The Director General
of Artillery.

REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. } *To ascertain the relative strength of various kinds of Powder.*

Shoeburyness, 8th April 1856.

Description of Powder used.	No of Rounds.	Height of Axis of Piece above the plane Ft. In.	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight.	Recoil. F. I.	Range. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Barometer 29·136. Thermometer 55. Wind E. S. East 6. Direction of Ranges } Between the shot and shell ranges. REMARKS.
Waltham Abbey.	1	about. 11-0	13 In. Sea Service Mortar	20-0	The Elevation throughout was as near as possible 46°.	Sec. 5th 30-0	2-4	4031	,,	53	4037
	2	,,		,,		30-1	2-10	4111	325	,,	
	3	,,	,,	,,		29-3	2-5	3970	,,	149	
Wettern.	4	,,	,,	,,		not obsd.	2-2	3950	130	,,	3952
	5	,,	,,	,,		Do.	2-7	3960	,,	177	
	6	,,	,,	,,		31-1	2-4	3947	96	,,	
Claremont	7	,,	,,	,,		32-0	2-6	4105	,,	40	3830
	8	,,	,,	,,		29 4	2-2	3775	208	,,	
	9	,,	,,	,,		28-0	2-0	3610	,,	78	
Prussian.	10	,,	,,	,,		28-2	1-6	3210	,,	125	3350
	11	,,	,,	,,		28-0	1-8	3455	,,	56	
	12	,,	,,	,,		28-0	1-6	3400	193	,,	

Shells plugged, filled with sand, weighted to 202 lbs.
The Mortar was laid down the range.

The Director General
of Artillery.

No. 1. REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. — *To test ranges and durability of 9 Pdr. Brass Gun of the Service, in comparison with Colonel Dundas's wrought Iron 9 Pdr. Gun of 18 Cwt.*

Shoeburyness, 7th August 1855.

No. of Rounds.	Height of Axis of Gun above the Plane. ft.in	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight. Sec.	Recoil. ft. in.	1st Graze. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Remarks.
1	15-0	9 Pdr. Brass Gun 13½ Cwt.	3-0	P.B.	Not taken.	13-0	600	2	..	Barometer 29·315. Thermometer 68° Wind—S. S. West 6. Direction of Range E. × ½ South.
2	,,		,,	,,		12-0	620	2	..	
3	,,		,,	,,		11-9	570	In line.		
4	,,		,,	¼°		11-8	696	3	..	
5	,,		,,	,,	Secs. 5th 2-0	11-4	720	In line.		
6	,,		,,	,,	1-4	11-6	685	2	..	
7	,,		,,	½°	notobsd.	10-11	702	5	..	
8	,,		,,	,,	1-4	10-8	706	..	1	
9	,,		,,	,,	2-1	10-6	828	6	..	
10	,,		,,	¾°	2-1	11-0	828	7	..	
11	,,		,,	,,	2-0	10-7	755	..	2	
12	,,		,,	,,	2-0	10-5	722	..	2	
13	,,		,,	1	1-4	10-2	728	2	..	
14	,,		,,	,,	2-1	10-6	740	..	3	
15	,,		,,	,,	2-2	10-8	905	5	..	
16	,,		,,	2	2-4	10-3	920	In line.		
17	,,		,,	,,	3-0	10-6	996	1	..	
18	,,		,,	,,	3-2	10-2	1162	..	1	
19	,,		,,	3	3-4	10-6	1248	4	..	
20	,,		,,	,,	notobsd.	11-5	1368	..	3	
21	,,		,,	,,	3-4	10-4	1240	14	..	
22	,,		,,	4	Not taken.	12-6	1548	..	3	8th Aug. 1855. Wind. S. S. W. 2.
23	,,		,,	,,		12-7	1570	14	..	Platform wet.
24	,,		,,	,,		12-6	1548	..	11	
25	,,		,,	5		12-6	1756	18	..	

BODLEIAN

The Director General of Artillery.

No. 2. **REPORT OF EXPERIMENTAL PRACTICE.**

NATURE AND OBJECT OF THE EXPERIMENT. { *Continuation of Practice with* 9 *Pdr. Brass Gun.*

Shoeburyness, 8*th August* 1855.

No. of Rounds.	Height of Axis of Gun above the plane.	Nature and weight of Ordnance.	Charge.	Elevation.	Time of Flight.	Recoil.	1st Graze.	Deflection.		Barometer 29·275. Thermometer 70° Wind S. S. West 2 variable. Direction of Range E. × ½ South. Rain.
	Ft. In		lbs.oz	Deg	Sec.	ft. in.	yds.	Left. yds.	Right. yds.	REMARKS.
26	15-0	9 Pdr. Brass Gun 13½ Cwt.	3-0	5°	Not taken.	12-5	1740	..	22	Platform wet.
27	,,		,,	,,		12-3	1752	..	11	
28	,,		,,	6		12-6	1740	8	..	
29	,,		,,	,,		12-2	1825	16	..	
30	,,		,,	,,		12-5	1875	..	20	
31	,,		,,	7		12-6	2053	1	..	
32	,,		,,	,,		12-5	1930	..	5	
33	,,		,,	,,		13-0	2186	..	22	
34	,,		,,	10		13-0	2550	40	..	
35	,,		,,	,,		12-0	2480	..	80	
36	,,		,,	,,		11-6	2042	16	..	

Elevation by Quadrant.

After the firing the Gun was examined, and shewed

Vent at top.......................... ·222
bottom................ ·222

The searcher took two holes between the Dolphins, and two others more towards the seat of the shot, these holes could not be perceived with the mirror, the wax impression shewed them thus— θ θ

The Director General
of Artillery.

No. 3. REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. { *To test ranges, and durability of 9 Pdr. Brass Gun of the Service, in comparison with Colonel Dundas's Wrought Iron 9 Pdr. Gun of 18 Cwt.*

Shoeburyness 10*th August* 1855.

No. of Rounds.	Height of Axis of Gun above the Plane. ft.in	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight. Sec.	Recoil. ft.in	1st Graze. yds.	Deflection.		Barometer 30·85. Thermometer 80.° Wind South 2. Direction of Range E. × ½ South. REMARKS.
								Left. yds.	Right. yds.	
37	15-0	9 Pdr. Gun.	4-0	P.B.	Not taken.	12-5	510	In line.		
38	"	"	"	"		12-6	570	do.		
39	"	"	"	1°		12-6	840	5	..	
40	"	"	"	"		12-6	800	In line.		
41	"	"	"	2°		13-0	1120	3	..	
42	"	"	"	"		13-3	1123	..	1	
43	"	"	"	3°		13-3	1500	22	..	
44	"	"	"	"		13-6	1290	13	..	
45	"	"	"	4°		13-3	1575	28	..	
46	"	"	"	"		13-3	1450	12	..	
47	"	"	"	5°		13-1	1634	18	..	
48	"	"	"	"		13-2	1840	28	..	
49	"	"	"	6°		12-9	1990	..	20	
50	"	"	"	"		13-3	1850	28	..	
51	"	"	"	10°		13-7	2420	58	..	
52	"	"	"	"		13-6	2530	12	..	

Elevation by Quadrant.

The trail of this Gun recoiled off the platform into deep sand.

No alteration either in the interior, or exterior of this Gun.

The Director General
of Artillery.

No. 4 REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 16*th August* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun of the Service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·115. Thermometer 80.° Wind. Direction of Range.

9 Pdr. Brass Gun, placed on Skids.

10 Rounds—4 lbs., 1 Shot, 1 Wad.
Gun examined—Vent at top.. ·22
,, ,, bottom.............................. ·22

The Searcher caught at the same spots as formerly noted, the indentations are somewhat deeper.

17th August 1855.

5 Rounds—5 lbs., 1 shot, 1 Wad,
Gun examined—No alteration either inside or outside,
5 Rounds—5 lbs., 2 shot, 1 Wad,
Gun examined—No alteration, Vent at top................ ·22
,, ,, bottom............ ·22
3 Rounds—6 lbs., 2 shot, 1 Wad,
Gun examined—No alteration, Vent at top............... ·22
,, ,, bottom.......... ·22
3 Rounds—6 lbs., 2 shot, 1 Wad.
Gun examined—Searcher shewed the indentations formerly noticed, enlarging. Vent at top............ ·22
,, ,, bottom....... ·22

No. 5 REPORT OF EXPERIMENTAL PRACTICE.

Shoeburynes 20 *August* 1855

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30· Thermometer 68° Wind—S. S. West 6. Direction of Range.

9 Pdr. Brass Gun placed on Skids.

3 Rounds—6 lbs., 2 Shot, 1 Wad.
Gun examined—No alteration.
Searcher caught in same place as formerly noted.
3 Round—6 lbs., 2 Shot, 1 Wad—Vent at top.......... ·22
,, ,, bottom...... ·22

Gun examined, very slight increase of the indentations formerly noted.

3 Rounds—6 lbs., 2 Shot, 1 Wad.
Gun examined—No alteration.

3d September 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad, Vent at top......... ·22

,, ,, bottom... ·22

Gun examined—The holes formerly noticed slightly enlarged.

3 Rounds—6 lbs., 2 Shot, 1 Wad, Vent at top......... ·22

,, ,, bottom... ·22

Gun examined—The searcher caught one fresh slight indentation in the middle of the chase.

A shot broke at the discharge of two of these rounds.

3 Rounds—6 lbs., 2 Shot, 1 Wad, Vent at top......... ·22

,, ,, bottom... ·22

1 Shot broke at the discharge in one of these rounds.

No. 6 REPORT OF EXPERIMENTAL PRACTICE.

Shoeburynes 4th September 1855

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30. Thermometer 69.° Wind E. S. E. 5. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds— 6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

The impression indicates a slight parting of the Copper Vent from the interior.

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined,... ... ... Vent at top............ ·22

,, ,, bottom........ ·22

The indentations formerly noticed, slightly increased.

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

A Shot broke at the discharge, in one of these rounds.

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

5th September 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,

Gun examined—No alteration, Vent at top............ ·22

,, ,, bottom....... ·22

No. 7. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness, 6th September 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·115. Thermometer 65° Wind North 5. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—The indentations formerly noted enlarging ... ... Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

11*th September* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—The indentations formerly noted slightly enlarging... ... ... Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

No. 8. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 12*th September* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·115. Thermometer 78.° Wind West 2. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alterations, Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·22

13*th September* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top........... ·22
,, ,, bottom....... ·22

2 Rounds—6 lbs., 2 Shot, 1 Wad,

14*th September* 1855.

1 Round—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·22

No. 9 REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 15*th September* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·75 Thermometer 69° Wind—West 4. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alterations Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom........ ·22

3 Rounds—6 lbs., 2 shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom...... ·22

3 Rounds—6 lbs., 2 shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·22

22nd September 1855.

3 Rounds—6 lbs., 2 shot, 1 Wad,
Gun examined—The indentations formerly noticed, a little enlarged... ... ... Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·22

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, except in Vent,
Vent at top............ ·22
,, ,, bottom....... ·25

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—The indentations increasing
Vent at top............ ·22
,, ,, bottom....... ·25

No. 10 **REPORT OF EXPERIMENTAL PRACTICE.**

***Shoeburyness, 24th September* 1855.**

NATURE AND OBJECT OF THE EXPERIMENT.	***To test the durability of* 9 *Pdr. Brass Gun in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.***	Barometer 30·135. Thermometer 65.° Wind N. E. 4. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·25

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined.—The indentations formerly noticed, all deeper and rougher... .... Vent at top............ ·22
,, ,, bottom....... ·25

3 Rounds—6 lbs., 2 Shot, I Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·25

26th September 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·25

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·25

28th September 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·25
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·25
2 Rounds—6 lbs., 2 Shot, 1 Wad,

29th September 1855.

1 Round—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·25
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, except in Vent,
Vent at top............ ·22
„ „ bottom....... ·32
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
„ „ bottom....... ·32

No. 11. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness, 1st October 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Brass Gun, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 29·215 Thermometer 68° Wind S. West 4. Direction of Range.

9 PDR. BRASS GUN PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, except in Vent,
Vent at top............ ·25
„ „ bottom....... ·35
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No aleration, except in Vent,
Vent at top............ ·25
„ „ bottom....... ·4
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·25
„ „ bottom....... ·4
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—the indentations formerly noticed are deeper... ... ... Vent at top............ ·25
„ „ bottom....... ·4
3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration. Vent at top............ ·25
„ „ bottom....... ·4

2nd October 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, except in Vent,
Vent at top............ ·25
„ „ bottom....... ·42

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—The indentations continue slightly to enlarge and deepen ... ... Vent at top............ ·25
„ „ bottom....... ·42

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·25
„ „ bottom....... ·42

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined, several small cracks now apparent near the muzzle; a small bulge appears in the chase, the indentations formerly noticed much deeper,
Vent at top............ ·25
„ „ bottom....... ·45

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined, and found quite unserviceable.

No. 12.

REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 2nd October 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*9 Pdr. Brass Gun Continued.*	Barometer. Thermometer. Wind. Direction of Range.

THE GUN IS CONSIDERABLY BULGED IN THE MUZZLE.

Summary of the foregoing reports, shewing the enduring powers of the 9 Pdr. Brass Gun of the service.

	Fired.		Charge.	
	86	Rounds	3 lbs.	Single Shotted.
	16	„	4 lbs.	do.
	10	„	4 lbs.	1 shot, 1 wad.
	5	„	5 lbs.	1 do. 1 do.
	5	„	5 lbs.	2 do. 1 do.
	174	„	6 lbs.	2 do. 1 do.
Total.	296			

No. 1. REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. { *To test ranges and durability of* 9 *Pdr. Iron Gun* (17 *Cwt.*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*

Shoeburyness 7*th August* 1855.

No. of Rounds.	Height of Axis of Gun above the plane F. I.	Nature and Weight of Ordnance.	Charge. lbs.oz	Elevation. Deg	Time of Flight. Sec.	Recoil. F.I.	1st Graze. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Barometer 29·315. Thermometer 68.° Wind S. S. West 2 & 6. Direction of Range E × ½ South. REMARKS.
1	15-0	9 Pdr. Iron Gun 17 Cwt.	3-0	P.B.	Not taken.	9-1	402	..	2	
2	,,		,,	,,		10-6	580	1	..	
3	,,		,,	,,		10-0	435	2	..	
4	,,		,,	¼		9-6	640	In	line	
5	,,		,,	,,		9-6	675	2	..	
6	,,		,,	,,		10-3	725	3	..	
7	,,		,,	½		10-0	630	..	1	
8	,,		,,	,,		9-5	740	2	..	
9	,,		,,	,,		9-6	728	5	..	
10	,,		,,	¾		8-10	835	10	..	At this round the wind increased to 6.
11	,,		,,	,,		9-11	755	not obsd.		Shot grazed in the water.
12	,,		,,	,,		9-2	775	6	..	
13	,,		,,	1	Sec 5th 2-2	9-4	840	2	..	
14	,,		,,	,,	2·1	8-6	785	9	..	
15	,,		,,	,,	not obsd	8-4	about 1000	not obsd.		Shot grazed in the water.
16	,,		,,	2	3-4	8-7	1190	..	9	
17	,,		,,	,,	3-1	7-8	1055	..	3	
18	,,		,,	,,	3-1	7-11	1075	..	1	
19	,,		,,	3	4-1	7-9	1280	2	..	
20	,,		,,	,,	4-1	7-7	1265	5	..	
21	,,		,,	,,	4-1	7-8	1210	8	..	
22	,,		,,	4	Not taken.	7-10	1660	..	6	8th August 1855.
23	,,		,,	,,		8-6	1507	..	14	Platform wet.
24	,,		,,	,,		8-6	1730	4	..	
25	,,		,,	5		7-11	1625	4	..	

No. 2. REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. { *Continuation of Practice with* 9 *Pdr. Iron Gun* 17 *Cwt.*

Shoeburyness 8*th August* 1855.

No. of Rounds.	Height of Axis of Gun above the plane F. I.	Nature and weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. F. I.	1st Graze. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Barometer 29·275. Thermometer 70.° Wind S. S. West 2 Variable. Direction of Range E × ½ South. Rain. REMARKS.
26	15-0	9 Pdr. Iron Gun 17 Cwt.	3-0	5	Not taken.	8-1	1548	..	13	Platform wet.
27	„		„	„		8-2	1606	6	..	
28	„		„	6		8-3	1996	..	31	
29	„		„	„		8-4	1752	In line.		
30	„		„	„		8-8	1790	11	..	
31	„		„	7		8-11	2125	24	..	
32	„		„	„		8-4	2200	..	10	
33	„		„	„		8-11	1825	..	42	
34	„		„	10		8-6	2250	36	..	
35	„		„	„		8-11	2475	..	50	
36	„		„	„		8-5	2209	..	49	

Elevation by Quadrant.

After the firing the gun was examined and shewed

Vent at top............ ·222

„ bottom....... ·36

No alteration in the interior or exterior of this Gun.

No. 3. **REPORT OF EXPERIMENTAL PRACTICE.**

Nature and object of the Experiment. { *To test ranges and durability of* 9 *Pdr. Iron Gun* (17 *Cwt.) of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*

Shoeburyness 9th August 1855.

No. of Rounds.	Height of Axis of Gun above the plane F. I.	Nature and weight of Ordnance.	Charge. lbs. oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. F. I.	1st Graze. yds.	Deflection. Left. yds.	Deflection. Right. yds.	Barometer 30. Thermometer 70.° Wind N. N. West 6. Direction of Range E × ½ South. Remarks.
37	15-0	9 Pdr. Iron Gun 17 Cwt.	4-0	P. B	Not taken.	8-11	657	..	4	
38	,,		,,	,,		9-6	575	In line.		
39	,,		,,	1		8-10	817	do.		
40	,,		,,	,,		8-11	998	..	11	
41	,,		,,	2		8-10	1225	14	..	
42	,,		,,	,,		8-10	1055	..	2	
43	,,		,,	3		8-11	1345	..	2	
44	,,		,,	,,		8-9	1375	..	14	
45	,,		,,	4		8-4	1615	20	..	
46	,,		,,	,,		8-4	1412	7	..	
47	,,		,,	5		7-11	1650	32	..	
48	,,		,,	,,		8-6	1710	..	5	
49	,,		,,	6		8-9	1820	..	33	
50	,,		,,	,,		8-7	1870	..	6	
51	,,		,,	10		8-8	2380	6	..	
52	,,		,,	,,		8-9	2375	..	20	

Elevation by Quadrant.

No alteration either inside or outside of this Gun since the last examination.

Vent at top............ ·22
,, ,, bottom...... ·45

No. 4. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburynes 14*th August* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Iron Gun* (17 *Cwt*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer. Thermometer. Wind. Direction of Range.

9 PDR. IRON GUN (17 CWT.) PLACED ON SKIDS.

10 Rounds—4 lbs., 1 Shot, 1 Wad,
Gun examined—Nothing observable, Vent inside... ·47
,, outside. ·22

15*th August* 1855.

5 Rounds—5 lbs., 1 Shot, 1 Wad,
Gun examined—Searcher shewed no defect,
Vent at top............ ·22
,, ,, bottom....... ·5

5 Rounds—5 lbs., 2 Shot, 1 Wad,
Gun examined—Searcher shewed no defect,
Vent outside........... ·22
,, inside............ ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

16*th August* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alteration, Vent at top............ ·22
,, ,, bottom....... ·52

No. 5. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 17*th August* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Iron Gun* (17 *Cwt.*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·125. Thermometer 83° Wind S. S. East, 2. Direction of Range.

9 PDR. IRON GUN (17 CWT.) PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—No alterations Vent at top............ ·22
,, ,, bottom....... .52

No. 6. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness, 26*th September* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Iron Gun,* (17 *Cwt.*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 30·185 Thermometer 69° Wind E. S. E. 5. Direction of Range.

9 PDR. IRON GUN (17 CWT.) PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

28*th September* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

29*th September* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

No. 7. REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 1*st October* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Iron Gun* (17 *Cwt.*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 29·215. Thermometer 68.° Wind S. West 4. Direction of Range.

9 PDR. IRON GUN, PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·52

3 Round—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... .22
,, ,, bottom. ·56

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·57

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·58

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·58

2nd October 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·59

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·59

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·59

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·29
,, ,, bottom. ·52

3 Rounds—6 lbs., 2 shot, 1 Wad,

No. .8

REPORT OF EXPERIMENTAL PRACTICE.

Shoeburyness 10*th October* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of* 9 *Pdr. Iron Gun* (17 *Cwt.*) *of the service, in comparison with Colonel Dundas's Wrought Iron* 9 *Pdr. Gun of* 18 *Cwt.*	Barometer 29·293. Thermometer 58.° Wind, North 4. Direction of Range.

9 PDR. IRON GUN, (17 CWT.) PLACED ON SKIDS.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·59

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·59

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·6

11*th October* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·6

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·6

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·6

12*th October* 1855.

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·62

3 Rounds—5 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·62

3 Rounds—6 lbs., 2 Shot, 1 Wad,
Gun examined—Nothing observable, Vent at top...... ·22
,, ,, bottom. ·63

2 Rounds— 6 lbs., 2 Shot, 1 Wad,
The gun burst—the bouching remains entire.

Summary of the foregoing reports shewing the enduring powers of the 9 Pdr. Iron Gun (17 Cwt.) of the service.

	Fired.		Charge.					
	86	rounds.	3	lbs.	single shotted.			
	16	,,	4	,,	do.			
	10	,,	4	,,	1	shot	1	wad.
	5	,,	5	,,	1	,,	1	,,
	5	,,	5	,,	2	,,	1	,,
	110	,,	6	,,	2	,,	1	,,
Total.	232							

No. 1. REPORT OF EXPERIMENTAL PRACTICE.

NATURE AND OBJECT OF THE EXPERIMENT. *To test ranges and durability of Colonel Dundas's Wrought Iron Gun in comparison with the Brass and Iron 9 Pdr. Guns of the service*

Sheeburyness 7th August 1855.

No. of Rounds.	Height of Axis of Gun above the plane	Nature and Weight of Ordnance.	Charge.	Elevation.	Time of Flight.	Recoil.	1st Graze.	Deflection.		Barometer 29·315. Thermometer 68.° Wind, S.S. West 6. Direction of Range E × ½ South.
	F. I.		lbs.oz	Deg	Sec.	F. I.	yds.	Left. yds.	Right. yds.	REMARKS.
1	15-0	Colonel Dundas's 9 Pdr. Wrought Iron Gun 18 Cwt.	3-0	P.B.	Not taken.	8-10	612	In line		
2	„		„	„		8-6	588	Do.		
3	„		„	„		7-10	562	Do.		Screw of the bed of the elevating screw, broke at this round.
4	„		„	¼		8-3	675	1	..	A second broke.
5	„		„	„		7-8	740	In line		A third broke.
6	„		„	„		7-8	635	Do.		
7	„		„	½		7-6	718	2	..	
8	„		„	„		8-6	705	In line		
9	„		„	„		7-7	710	2	..	
10	„		„	¾		7-8	805	2	..	
11	„		„	„		8-0	845	6	..	
12	„		„	„		Not taken	740	4	..	The 4th broke. Practice suspended in consequence.
13	„	Ditto.	„	1	Not taken.	10-6	898	..	2	8th August 1855. Wind NN.W.2 Rain.
14	„		„	„		10-6	825	4	..	Platform Wet.
15	„		„	„		10-0	825	In line		
16	„		„	2		9-11	1180	..	6	
17	„		„	„		10-0	1048	..	8	
18	„		„	„		10-2	1105	..	5	
19	„		„	3		10-3	1392	..	7	
20	„		„	„		10-4	1505	..	16	
21	„		„	„		10-6	1380	..	11	
22	„		„	4		10-4	1625	..	26	
23	„		„	„		10-5	1462	2	..	
24	„		„	„		10-4	1440	4	..	
	„		„	5		10-6	1756	..	16	

No. 2. **REPORT OF EXPERIMENTAL PRACTICE.**

NATURE AND OBJECT OF THE EXPERIMENT. } *Continuation of Practice with Colonel Dundas's Gun.*

Shoeburyness 8th August 1855.

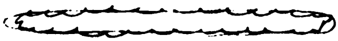
No. of Rounds.	Height of Axis of Gun above the plane	Nature and weight of Ordnance.	Charge.	Elevation.	Time of Flight.	Recoil.	1st Graze.	Deflection.		Barometer 29·275. Thermometer 70.° Wind, N. N. West 2. Direction of Range. E × ½ South. Rain.
								Left.	Right.	REMARKS.
	F. I.		lb. oz.	Deg	Sec.	Feet In.	yds.	yds.	yds.	
26	15-0	Colonel Dundas's 9 Pdr. Wrought Iron Gun 18 Cwt.	3-0	5	Not taken.	10-4	1625	,,	8	Platform Wet.
27	,,		,,	,,		10-0	1775	12	,,	
28	,,		,,	6		10-0	1915	8	,,	
29	,,		,,	,,		10-4	2170	,,	5	
30	,,		,,	,,		Not taken	1915	,,	8	
31	,,		,,	7		10-0	1850	,,	18	
32	,,		,,	,,		10-3	2360	,,	32	
33	,,		,,	,,		10-4	2040	,,	2	
34	,,		,,	10		10-6	2460	21	,,	
35	,,		,,	,,		10-2	2230	,,	69	
36	,,		,,	,,		10-3	2480	8	,,	

Elevation by Quadrant.

After the firing, the Gun was examined, and shewed

Vent at top............ ·222
,, ,, bottom...... ·222

No alteration in the interior, or exterior of this Gun, with the exception of a long indented streak 2 inches long, ·1 deep and ·2 wide, 4 inches from the Muzzle at the bottom of the bore, shewing thus.—



No. 3. REPORT OF EXPERIMENTAL PRACTICE.

Nature and object of the Experiment. *To test ranges and durability of Colonel Dundas's Wrought Iron Gun in comparison with the Brass and Iron 9 Pdr. Guns of the service.*

Shoeburyness 9th August 1855.

No. of Rounds.	Height of Axis of Gun above the plane F. I.	Nature and weight of Ordnance.	Charge. lbs.oz.	Elevation. Deg	Time of Flight. Sec.	Recoil. F. I.	1st Graze. yds.	Deflection.		Barometer 30. Thermometer 70.° Wind, N. N. West 6. Direction of Range E × ½ South. REMARKS.
								Left. yds.	Right. yds.	
37	15-0	Colonel Dundas's 9 Pdr. Wrought Iron Gun 18 Cwt.	4-0	P. B	Not taken.	10-6	625	In line.		
38	„		„	„		10-2	625	..	1	
39	„		„	1		10-5	940	..	4	
40	„		„	„		10-7	1005	..	7	
41	„		„	2		10-6	1325	..	6	
42	„		„	„		10-6	1180	In line		
43	„		„	3		10-9	1440	..	6	
44	„		„	„		10-5	1430	..	6	
45	„		„	4		10-7	1780	..	24	
46	„		„	„		10-10	1663	..	6	
47	„		„	5		10-7	2145	In line		
48	„		„	„		10-5	1772	..	10	
49	„		„	6		10-4	1900	..	54	
50	„		„	„		10-7	2075	32	..	
51	„		„	10		9-11	2510	40	..	
52	„		„	„		10-2	2325	..	56	

Elevation by Quadrant.

As the trail of this Gun recoiled off the platform into deep sand, which checked it materially, no comparison can be drawn between the recoils of this gun and the Iron 17 Cwt. Gun, the trail of which never left the platform, even with 4lbs. charges. Colonel Dundas's Gun examined; No alteration either inside or outside, since last examination.

Vent at top............ ·22
„ „ bottom....... ·22

No. 4.

REPORT OF EXPERIMENTAL PRACTICE.

Skoeburynes 10*th August* 1855.

NATURE AND OBJECT OF THE EXPERIMENT.	*To test the durability of Colonel Dundas's Wrought Iron Gun, in comparison with the Brass, and Iron 9 Pdr. Guns of the service.*	Barometer 30·85. Thermometer 80° Wind, South 2. Direction of Range E × ½ South

COLONEL DUNDAS'S WROUGHT IRON GUN, PLACED ON SKIDS.

10 Rounds—4 lbs. 1 Shot, 1 Junk Wad.

Gun examined.—The indentation near the muzzle, formerly noticed, is somewhat deeper and longer.

No alteration either internally or externally at the vent.

The joining at the hoop between the base ring and vent field astrigal, has parted all round on the right side, sufficiently wide to admit the blade of a pen-knife; I could not detect any escape of gas. The searcher caught at nearly the same place internally.

13TH AUGUST 1855.

5 Rounds—5 lbs. 1 Shot, 1 Wad,

At the second round, some escape of gas took place in spots at the 4th joint from the base ring, the joint however appeared very close.—Gas escaped in spots at this joint; at each round afterwards, searcher caught near the Breech as at previous examination; the opening at the joint between the base ring and vent field astrigal more enlarged.

5 Rounds—5 lbs. 2 Shot, 1 Wad,

At the 3d round of this series, the joint near the base ring before noticed much more open, it admitted a probe ·2 thick and 1¾ inches deep; at each successive round continued opening, the joint next to it opening also.—The searcher caught near the breech as before. Vent, no alteration.

3 Rounds—6 lbs. 2 Shot, 1 Wad,

At the 3d Round, the breech was torn nearly off, a large opening at the right side renders the gun quite unserviceable. The vent field was blown some distance to the rear, and some fragments of iron. The breech still adheres to the bore on the left side, but one of the rings is gone and cannot be found.

ROYAL CARRIAGE DEPARTMENT,
August, 1855.

Table of Tonnage and weight of one of the following Travelling Carriages, Wagons, Carts, Gyns, &c. used in Land Service.

ONE TON EQUAL TO 40 CUBIC FEET.

				Tonnage		Weight			
				Tons.	Feet.	Cwt.	Qrs.	lbs.	
Carriages.	Travelling Complete.	For Iron Ordnance.	8 Inch 52 Cwt.	6	,,	34	2	12	
			24 or 32 Pdr. 50 Cwt.	6	,,	34	,,	22	With Bullock.
			18 Pdr. 38 and 42 Cwt. 32 Pdr. 42 Cwt.	4	39	27	2	9	Pole and Chain.
			12 Pdr. 21 Cwt.	4	7	18	3	24	qrs. lbs. Weighing 2—19
			Howitzer.. 10 Inch	6	17	39	,,	9	
			Howitzer.. 8 ,,	5	37	33	2	0	Do. Do. Do.
		For Brass Ordnance.	12 Pounder	5	33	22	,,	10	
			9 ,,	5	1	20	2	14	
			6 ,,	4	21	17	3	5	
			Howitzer. 32 Pdr.	5	29	23	3	13	
			Howitzer. 24 ,,	5	6	21	,,	17	
			Howitzer. 12 ,,	4	21	18	3	14	
		Ammunition Wagon		5	36	20	,,	3	9 Pdr. without Ammunition.
		Forge ,,		5	38	19	1	,,	
		StoreWagon (without spare wheel)		5	11	18	1	10	
		Small Arm Ammunition Wagon		4	36	14	2	16	
		Small Arm Ammunition Wagon (New pattern)		4	23	17	,,	26	
		Rocket	12 Pounder	7	33	22	,,	8	
			6 ,,	5	17	20	1	20	
		Pontoon	Large	3	20	42	2	14	
			Small	,,	,,	22	2	5	
Wagons			Flanders	5	,,	16	1	25	
			Platform	3	16	21	3	18	
			Sling	8	11	31	3	26	
			Bread	4	14	13	1	26	
			Telegraph	8	23	24	3	16	
Carts			Forge Cavalry	4	32	11	2	3	
			Hand	1	10	4	3	4	
			Sling	3	38	16	1	17	
			Store	3	16	9	1	,,	
			French	1	32	5	2	13	
			Maltese with water barrel and Bridge equipment	5	22	8	2	18	
Hospital equipment			Hospital Wagon	5	25	12	2	,,	
			,, Car	2	20	7	,,	,,	
			MalteseCart with folding litters.	2	16	5	3	10	
			Litters and Pack saddle, (in a case)	,,	20	2	0	2	
			Chairs and Pack saddle ,,	,,	15	1	3	4	
Land Transport Corps			Wagon Light Forage	3	7	10	1	20	
			,, Lumber	2	9	9	1	13	
			Cart Light	2	8	6	,,	6	
			Maltese Cart	1	30	4	,,	17	
			Pack Saddle 9 in a Case	1	12	5	,,	,,	
			Pack Saddle 6 ,, ,, ,,	,,	35	3	1	12	
			Car	2	20	6	,,	,,	
Drags			Large	2	7	17	1	24	
			Small	1	2	7	3	3	
Gyns triangle			Large	1	23	9	2	22	
			Small	1	2	7	3	3	
Capstan Crab				,,	31	3	3	26	
Portable Forge and Pack Saddle in wooden case				,,	17	2	1	3	
Platforms.	Alderson's	Gun		1	32	24	,,	13	
		Mortar..	13 Inch	1	27	24	3	16	
			10 ,,	,,	30	9	3	25	
	Siege (New pattern)			,,	30	11	,,	,,	
Bruising Machine Cart (Captain Swinten's Patent)				5	6	16	,,	,,	

ROYAL CARRIAGE DEPARTMENT,
December, 1854.

Detail of a Battery of 32 Pounder Guns 42 Cwt., equipped for Field Service in the East.

		Weight of one.	
		Unloaded.	Loaded.
Carriages.	6 Gun Carriages 32 Pounder 42 Cwt.	30 Cwt.	72 Cwt.
	* 12 Store Limber Wagons for Ammunition	18½ „	47 „
	2 Flanders Wagons for Stores	17 „	about. 36 „
	1 Forge Wagon	17 „	22 „
	1 Store Cart	9¼ „	
	1 Spare Gun Carriage	30 „	52¼ „
Total..	23 Carriages.		

	Cwt.	qrs.	lbs.	
* with spare wheel	1	3	24	heavier.

Gun Carriage. The Guns are mounted on the 18 Pounder Travelling Carriage, with the New Pattern 24 Pounder Axletree and wheel (See Note)

The Limbers are fitted with Iron Scrapers to prevent the mud collecting between the Splinter Bar and Wheel.

Trail Box. The Trail-Box carries the following Small Stores—1 Tube Pocket and strap; 1 Box of Tubes; 1 Thumbstall; 3 Portfires; 1 Portfire clipper; Portfire stick on Box or Carriage; 2 Lanyards for Friction Tubes; 1 Leather Cylinder; 2 Linchpins and Washers; 1 Skein of Marline; 1 Skein of Hambro line; Slowmatch; 2 Punches for Vents; 1 Set of Priming Irons; 1 Knife; 1 Pair of Scissors; 1 File; Rammer head; Coating and crown for Spunge; Spikes, spring and common.

A couple of Drag-ropes and a Prolong are carried on the Gun Limber; Poles for Bullock draft are supplied as well as Shafts.

Note.—"New pattern 24 Pounder Axletree and Wheel." The Stock pipe-box and Axletree Arm of the present pattern have been shortened 2 ins. making their length the same as the present 18 Pounder Stock &c.

1. To fit the present 18 Pounder Wheels on the New Arm, it is only necessary to take out the 18 Pounder pipe-box, and fit in the new 24 Pounder Box, 12 of which are sent as spare.

2. To fit the present 24 Pounder Wheel on the New Arm, change the pipe-box (as before) or else shorten the present box 2 inches. Shorten the stock two inches by taking off ¾ inches in rear, and 1¼ inches in front. This leaves the position of Spokes and track of Wheel the same as at present.

Ammunition Wagon.—The Ammunition is carried in Store-Limber Wagons: these being lighter and carrying a greater number of rounds than the 32 Pounder Howitzer Wagon. 12 of these Wagons are attached to the Battery carrying 72 Rounds each, making 144 Rounds per Gun in the Field, the proportion in each Wagon being,

32	Rounds	Solid shot.
16	„	Shrapnel.
16	„	Common shell.
8	„	Case.

with Bursters and Fuzes in proportion.

The shot and shell are packed in boxes of 4 Rounds each.

			Cwt.	qrs.	lbs.
Weighing...		4 Solid shot	1 ,,	1 ,,	7
		4 Shrapnel	1 ,,	1 ,,	4
		4 Common shell	0 ,,	3 ,,	21
		4 Case	1 ,,	1 ,,	19
Contents of Leather Cases, Boat Magazine Pattern.	Shrapnel...	16 Bursters. 2 Boxes of Fuzes, 12 each. Boring implements, Funnel, Mallet and Setter			13½
	Common Shell......	16 Bursters 1 lb. 2 Boxes of Fuzes, 12 each. Boring implements, Funnel, Mallet and Setter			16½

The Bursters, Fuzes &c. in two leather cases, one for Shrapnel the other for Common Shell. In front of the Wagon there is a partition for spare small stores. A spare Box for small stores is also supplied. Park Pickets and Tent Poles can be carried on the sides of the Wagon, a Maul, Horse-shoe and Grease boxes underneath. Tents &c. inside on top of shot boxes.

The Limbers are fitted with intrenching tools as usual, six carry Lifting Jacks. 6 of these Wagons carry a spare wheel.

Store Limber Wagon packed as Ammunition Wagon for 32 Pounder Gun, 42 Cwt.

Limber.			Body.			
24—6 lb. Cartridges.	Horse shoe box 10 Sets.	Partition for Small Stores.	Above 4 Solid shot. Below 4 do. do.	Above 4 Solid shot. Below 4 do. do.		Horse shoe for 10 Sets.
			Above 4 Common shell Below 4 do. do.	Above 4 Common shell Below 4 do. do.		
24—6 lb. Cartridges.	....		Above spare box for small stores. Below 4 Case.	Above Bursters and Fuzes Shrapnel. Below 4 Case.	Above Bursters and Fuzes Com. Shell.	
24—6 lb. Cartridges.	Horse shoe box 10 Sets.		Above 4 Shrapnel. Below 4 do.	Above 4 Shrapnel Below 4 do.		Grease Box 28 lbs.
			Above 4 Solid shot. Below 4 do. do.	Above 4 Solid shot. Below 4 do. do.		

Store Wagons.—The Stores of the Battery are carried in two Flanders Wagons. A pair of Spare Shafts, and Splinter bars are attached to the sides of the Wagons. A spare Axletree and Fore Wagon wheel underneath, Small store box in front, containing 14 lbs. Grease, 10 sets Horse shoes and Nails, spare India Rubber Springs and Bolts, Wrench, Hammer, Linchpin and Washer, Spare punches and other Stores inside.

Spare Gun Carriage.—The spare Gun Carriage, carries 2 spare Gun and 2 spare Gun Limber Wheels, 2 spare Gun, and 1 spare Limber Axle tree, 1 spare Pole, 2 spare Shafts, and 1 spare Elevating screw with nut.

The Forge-Waggon and Store Cart as usual.

ROYAL CARRIAGE DEPARTMENT,

December, 1854.

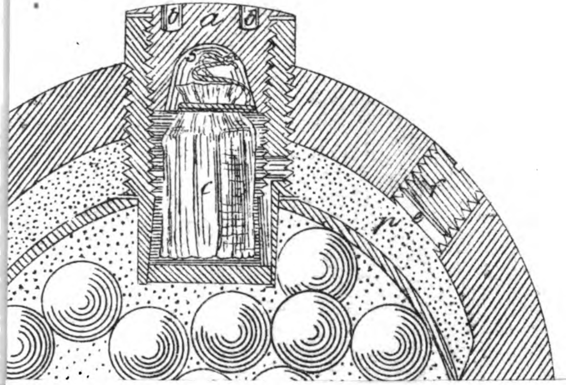
Plate. 3.

ells.

a Metal Screw Plug.

ice.

Fig. 2.



Royal Carriage Department,
December, 1854.

Portable Platform for Travelling or Garrison Carriages. (Plate 4.)

This platform consists of.

Two Inclined planes 17 feet long, 12 inches wide, Slope 3°.

One Front Transome 7.′×16″×4.″ laid flush with surface of ground to which the inclined planes are pivotted.

Two Sleepers, one 7.′×6″.×3,″ the other 8′×6″×3″ these are laid flush with the ground, as marked in the drawing.

One Trail Plank, 10,′×16″ ×4.″ this plank is placed on the ground, so that the trail may rest on it, about 3 feet from the front.

This allows of the trail recoiling beyond it, and striking the Ground in rear, thereby checking the recoil, and preventing the gun running forward of itself.

TO LAY THE PLATFORM AND MOUNT GUN.

1st Lay the Front Transome and sleepers flush with the surface of the ground, and level the ground between them.

2nd Run the gun into position, then with a Screw Jack raise one wheel—run the inclined plane under it and pivot it to the transome—then the same on the other side, the Ribbands should be inside.

3rd Lay the Trail Plank under the trail, sufficiently far forward for No. 1 to stand on it when laying the Gun.

TO TRAVERSE.

One man at each end of the platform with a hand-spike, and one, or two at trail of Carriage; the trail plank has to be shifted, when much traversing is required.

The whole of the Platform is cut out of a log of Fir 17′× 16″×16″ and packs up into its original shape for Travelling.

Those parts of the platform which require strengthening, are shod with sheet Iron. The front transome, and trail plank, are furnished with spikes to secure them to the ground, and when packed, these spikes go into corresponding holes, in the inclined planes, to keep them together; if the ground is soft, a picket is required behind the trail plank.

When used with a Garrison Carriage, the inclined planes are brought closer together, and pivotted to the holes marked A on the plan, the Trail-plank is not required, but can be used for a sleeper.

Weight 11 Cwt,—Tonnage (measurement) 30 feet,

(Signed) H. Clerk,
Capt. Royal Artillery.

Abstracts of Orders affecting the Ordnance and Ordnance Equipments of the Royal Army.—In continuation of the foregoing papers furnished by Captain Hutchinson.

Account of Additions and Changes in Ordnance, Ammunition, Carriages, Platforms, &c, adopted into the Service, under the Authority of the Master General and Board of Ordnance, since the last Return.

Director General's Office Woolwich,
29*th December,* 1852.

1.—Small Arm Ammunition for the New Rifle Musket of 1851. Cup Ball, $2\frac{1}{2}$ drs. of Powder.

Board's Order 2d June 1851 $\frac{O}{172}$.

2.—Small Arm Ammunition, for the Percussion Musket of 1842, rifled for Marines and Royal Navy. Cup Ball, 3 drs. of Powder.

Board's Order 23rd September 1852 $\frac{S}{1448}$.

3.—Shells invented by the late General Shrapnel, in fuure to be called " Shrapnel Shells" instead of Spherical Case Shot.

General Order 11*th June,* 1852 $\frac{M}{236}$.

4.—Boxes, to contain Moorsom's Shells for Naval Service, to be secured, as proposed by Lieutenant Colonel Tylden, and stamped with lead in lieu of sealing-wax, for greater security.

Board's Order 1*st September,* 1852 $\frac{O}{4824}$.

5.—Naval Shells with time Fuzes, to be fitted with a Tin

Cap and Lappets, as proposed by Lieutenant Colonel Tylden, to prevent the fuze being withdrawn for the purpose of wantonly removing the powder.

Board's Order 18th October, 1852 $\frac{L}{320}$.

6.—A new pattern Whip for the drivers of the Royal Horse Artillery and Field Batteries.

Board's Order 26th July, 1852 $\frac{A}{429}$.

7.—A new pattern Head Collar for the Royal Horse Artillery and Field Batteries.

Master General and Board's Minutes,
15th and 18th October, 1852.

8.—Spunges, to be made according to a pattern prepared and deposited in the Royal Carriage Department.

Approved by the Master-General, and Board.
12th March 1851, $\frac{M}{84}$.

9.—Iron Gun Carriages, mounted on Ground Platforms, to be supplied with Wooden Trucks throughout, and a proportion of wooden Trucks retained in store, equal to one-sixth of those exposed on the Works.

Approved by the Master-General and Board,
18th August 1851, $\frac{M}{232}$.

10.—A loop to be placed on Garrison Carriages of wood and iron, for carrying the priming wire, pricker, and drift.

Suggested by Captain Anderson R. H. A.
and Approved by the Master-General and Board,
8th October 1852, $\frac{M}{411}$

Account of Additions and Changes in Ordnance, Ammunition, Carriages, Platforms, &c. adopted in the Service by the Authority of The Master General and Board of Ordnance since the last Return.

1. In consequence of the introduction of Friction Tubes to Land Service, the Iron Guns, for Batteries, are no longer supplied with direct Acting Detonating Hammers, but a small

proportion of Portfires, and Common Tubes are to be supplied.

Master Genl.'s Orders, 18th Aug., 1853, and Board's Order,
25th August, 1853, $\frac{M}{495}$.

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2. 42 Pounder and 56 Pounder Iron Guns, ordered to be supplied with a proportion of Shrapnel Shells.

On the recommendation of the Coast Defence Committee.
Master General and Board's Orders.
28th January, 1853.

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3. The 68 Pounder of 95 cwt. 10 feet introduced to the Land Service.

By recommendation of the Director General of Artillery.
Master General and Board's Order,
13th July 1853, $\frac{M}{411}$.

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4. *Store Limber Wagon* to be used in the Field with a 24 Pounder Siege Gun, instead of a Flanders Wagon.

Approved by Master General and Board,
3rd November, 1852.

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5. *New Pattern Ammunition Box* for 500 rounds of Musket or Miniè percussion Ball Cartridges, and Zinc Box for Percussion Caps.

Recommended by the Select Committee.
Approved by Master General and Board,
20th December, 1852, $\frac{M}{615}$.

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6. *Improved Store Cart* proposed by Colonel Colquhoun, R. A., and recommended by the Select Committee to be substituted for that of the Old Pattern in future supplies to the Field Batteries of Horse and Foot Artillery.

Approved by Master General and Board's Order,
14th February, 1853, $\frac{M}{77}$.

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7. *Limbers of Field Battery Carriages.*—A Bar of Ash to be placed behind the splinter bar under the draught loops

for the entire length of the Foot-board, so as to fill up the space now left between the Splinter-Bar and Foot-board, to prevent accidents.

Approved by Master General and Board,
15th July, 1853, $\frac{M}{414}$.

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8. *Shrapnel Fuzes for Field Equipments.*—The new Inch Fuze to be made with additional $\frac{2}{10}$ths Inch of Wood, and that as well as the C, D, and E, Fuzes, primed according to Captain Boxer's Method.

Approved by Board's Orders,
18th April, 1853, $\frac{M}{173}$.

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9. *Friction Tubes* : *Tozer's Pattern* for Service at Home and Abroad.

Approved by Board's Orders,
24th June, 1853, $\frac{M}{631}$.

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10. *Teak Wood Plugs* in lieu of Corks for Shrapnel and Common Shells.

Approved by Board's Orders,
24th June, 1853, $\frac{M}{363}$.

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11. Blank Percussion Ammunition to be in future marked "Blank Cartridge for all Arms, Land Service."

Approved by Board's Orders,
4th July, 1853, $\frac{L}{207}$.

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12. Cartridges for Rifle Musket 1853 Pattern, Charge 2½ drs.

Approved by Board's Orders,
12th August, 1853, $\frac{C}{492}$.

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13. Lanyards for Tozer's Friction Tubes for Garrison and Field Guns.

Approved by Board's Orders,
17th August, 1853, $\frac{M}{484}$.

14. Cases, Leather for Cartridges.

No.			
No. 1.	To contain	Cartridges for	10 Inch Guns.
2.	,,	,,	68 Pounder Guns.
3.	,,	,,	68 Pounder Carronades and 8 inch Guns.
4.	,,	,,	32 Pounder Guns of 63 and 56 cwt.
5.	,,	,,	32 Pounder Guns of 50 and 42 cwt.
6.	,,	,,	32 Pounder Guns of 32 and 25 cwt. and 32 Pounder Carronades.
7.	,,	,,	18 Pounder Guns of 22 and 15 cwt. and 18 Pounder Carronades.

Approved by Board's Orders,
11th May, 1853, $\frac{S}{1059}$.

Office of Ordnance,
10th October, 1853, $\frac{M}{2183}$.

$\frac{55\text{ D.}}{149}$ Account of Alterations and Additions in Ordnance, Carriages, &c., adopted in the Service, by the Authority of the Master General and Board of Ordnance, since the last Return

Office of Ordnance, 31st January 1855.

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1. That the charges to be used in firing Hot Shot, shall not in future exceed three-fourths of the weight of the respective Service charges, fcr the several natures of Ordnance; and that Junk Wads of the Service, being considered unnecessarily heavy and large, are in future to be made of one half the thickness and weight of those now in use for the guns of the Artillery Service.

It is not however, to interfere in any way with the use of the grummet Wads, as at present authorized.

Board's Order, 11th July, 1854 $\frac{M}{4604}$.

2, That the 8 inch, 32 pounder and 24 pounder Shrapnell shells required for the service, may be constructed on Captain Boxer's Diaphragm Pattern.

Board's Order 17th October, 1853 $\frac{M}{2197}$.

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3. Charge of Powder for the new Artillery Carbine.—Pritchett's Bullet reduced to 2 drams.

Board's Order 9th March, 1853 $\frac{A}{170}$.

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4. Bursting Powder for Common Shells, Land Service, to be the same as for the Sea Service, viz.—

	lbs.	ozs.
13 Inch	10	8
10 „	5	8
8 „ ...or 68 pounder	2	4
6 „ ...or 32 pounder	1	0

Board's Order 8th December 1854 $\frac{M}{4796}$.

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5. *Hand Leathers.*—With the exception of 6 pounder Guns and Waggons, in charge of the Officer Commanding the Field Batteries at Head Quarters, used for Drill, the Provision of Hand Leathers for the Carriages and Limbers of Field Batteries shall be discontinued in the Foot Artillery, and limited in the Horse Artillery to the Limber only—continuing the Leathers on 6 pounder gun and Waggon Limbers—and discontinuing the rest.

Recommended by the Select Committee.

Approved by Master General and Board's Order, 10th October, 1853 $\frac{M}{2186}$.

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6. *Garrison Carriages Common.*—Rear Chocks to be substituted for rear Trucks on Common Garrison Carriages of 8 inch Guns of 52 cwt., and on those for Guns of violent recoil.

Proposed by the Inspector, Royal Carriage Department.

Recommended by the Select Committee.

Approved by Master General and Board's Order, 10th October, 1853 $\frac{M}{2185}$.

7. Shot and Shell Boxes, for Land and Sea Service, sizes reduced from 47 to 22; and that in all future supplies (after the present old pattern boxes are used) to be of the new pattern.

Proposed by the Inspector, Royal Carriage Department.
Recommended by the Select Committee.
Approved by the Master General and Board's Order,
27th January 1854 $\frac{M}{11}$.

8. *Spunge Heads.*—To be made of the same quality of material that has hitherto been supplied by Messrs. Harris, and similar to the pattern Spunge Head with the runner Tie and grooved Block; the Fleecy Hosiery being fixed by Marine Glue, as prepared by the Royal Carriage Department.

Recommended by the Select Committee.
Approved by Master General and Board's Order,
6th February, 1854 $\frac{M}{811}$.

9. *Drag Shoes.*—Carriages proceeding on service to be supplied with one, with a proportion of spare, of the Pattern recommended by the Select Committee.

Approved by Board's Order,
14th February, 1854 $\frac{A}{131}$.

10. *Bellows for Forge Wagons.*—Improved description, proposed by the Inspector, Royal Carriage Department.

Recommended by the Select Committee.
Approved by Master General and Board's Order.
21st March, 1854 $\frac{M}{833}$.

11. *Powder Cases.*—Alteration in the construction.

Proposed by the Inspector, Royal Carriage Department.
Approved by Master General's Order,
18th March, 1854 $\frac{M}{831}$.

12. *Horse Shoe Boxes.*—Waggons of Field Batteries to have an additional Horse Shoe Box attached, with partition for nails and a cover.

Proposed by the Inspector, Royal Carriage Department.
Approved by Master General and Board's Order,
5th May, 1854 $\frac{M}{907}$.

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13. *Royal Artillery Harness.*—Changed from Black to Brown.

Board's Order,
12th December, 1853 $\frac{S}{1953}$.

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14. Royal Artillery Harness.—Iron Work made bright.

Board's Order,
27th March, 1854 $\frac{W}{2568}$.

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15. Alterations made in the patterns of Whips.

Board's Order,
23d August 1854 $\frac{W}{2899}$.

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16. Chain Reins—Pattern altered.

Board's Order,
16th August, 1854.

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17. Officer's Bridles and Saddle—Pattern Altered.

Board's Order,
2d November, 1853, $\frac{L}{4817}$; and 13th July, 1854: $\frac{O}{85}$.

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18. Non-Commissioned Officers' Bridles from Black to Brown, the same as those of the Royal Horse Artillery.

Board's Order,
12th December, 1853 $\frac{S}{1952}$.

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19. Spurs.—Pattern altered.

Board's Order.
19th May, 1854 $\frac{A}{679}$

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20. Brow Bands, added to Head Stall Collars.

Board's Order,
13th February, 1854 $\frac{A}{79}$.

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21. 24, 12, and 6 Pounder Rockets to be fired with Friction Tubes. Proposed by Lieut. Colonel Hardinge, K. H.
Recommended by the Select Committee.
Approved by the Lieutenant General and Board.
8th May, 1854, $\frac{M}{892}$.

22. Heavy Ordnance, mounted on Dwarf Traversing Platforms, to be fitted with new Elevating Screw and Iron Stool Bed.

Suggested by the late Colonel Colquhoun, and carried out by Captain Clerk, R. A., Assistant Inspector, Royal Carriage Department.

Recommended by the Select Committee.

Approved by the Lieutenant General.

9th September, 1854.

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23. *Spunge and Rammer Heads*, for 18 Pounder Guns to be fixed on separate staves.

Proposed by Lieutenant Colonel Hardinge, K. H.

Recommended by the Select Committee.

Approved by the Lieutenant General.

6th September, 1854.

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24. Portable Forge and Pack Saddle.

Proposed by the Inspector, Royal Carriage Department.

Recommended by the Select Committee.

Approved by the Lieutenant General,

11th September, 1854.

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25. 10 Inch Iron Howitzers, 125 Cwt.

Proposed by Colonel Chalmer.

Recommended by the Select Committee.

Approved by the Lieutenant General,

20th December, 1854.

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26. Spare Screw for Tangent Scale for Field Guns.

Proposed by Captain Brandling, R. A.

Recommended by the Select Committee.

Approved by the Lieutenant General,

11th December, 1854.

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27. Small Arm Ammunition Wagons, packed with Intrenching tools, and fitted with the means of fastening Tents, &c. carried on the Wagons in the mode adopted in the Roy-

al Carriage Department, to be followed in all future construction.

Approved by Board's Order,
18th September 1854 $\frac{M}{4673}$.

28. Propositions with reference to Shrapnel and other Shells and Fuzes.

Recommended by the Select Committee, 9th January, 1854, and approved by the Master General, 8th Feby. 1854.*

29. Propositions in continuation of those of 9th January 1854, with reference to Shrapnel and other Shells and Fuzes.

Approved by the Lieutenant General.
27th January 1855.†

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250 12) 55-$\frac{\text{H. \& S.}}{3292}$

Account of Alterations and Additions in Ordnance, Carriages, &c. adopted in the Service since the last Return, dated 31st January, 1855.

War Department, Pall Mall.
22nd October 1855.

1. Improved Fastenings to Small Arm Ammunition Boxes Proposed by Assistant Inspector, Royal Carriage Department.

Recommended by the Select Committe.
Approved 26th June, 1854 $\frac{M}{986}$.

2. Carriages for Heavy Ordnance, mounted on Dwarf Traversing Platforms—To be fitted with improved Elevating Screws and Iron Stool Beds, in order to give increased Elevation and Depression to the Guns.

Recommended by the Select Committee.
Approved 13th September, 1854 $\frac{M}{4674}$.

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* Vide pages 22, 23 and 24, paras, numbered from 1 to 14.

† Vide pages 29, 30, 31 and 32, paras, numbered from 1 to 15 and Tables A. B and C.

3. Sling Wagon with Windlass.

Proposed by Mr. F. Pellatt.

Recommended by the Select Committee.

Approved 9th October, 1854 $\frac{M}{8718}$.

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4. One Spring Spike and two Common Spikes to be supplied for each Garrison Gun, or Howitzer, as well as for each piece of Field Ordnance.

Proposed by Major-General Cator, C. B.

Recommended by the Select Committee.

Approved by Lieutenant-General of the Ordnance.

16th January, 1855.

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5. Carriages to be fitted (when applicable) with India Rubber Springs.

Proposed by Lieutenant Colonel Tulloh, R. A.

Approved by Lieutenant General of the Ordnance,

7th February, 1855.

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6. India Rubber Rings—To be applied to Elevating Screws of Field Ordnance.

Recommended by the Select Committee.

Approved by Lieutenant-General of the Ordnance.

19th February, 1855. $\frac{M}{1221}$.

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7. New Forge Wagon,

Proposed by Colonel Tulloh, R. A.

Recommended by the Select Committee.

Approved by Lieutenant General of the Ordnance,

27th February, 1855 $\frac{M}{1234}$.

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8. India Rubber Springs for Carriages generally in the Service.

Proposed by Colonel Tulloh, R. A.

Recommended by the Select Committee.

Approved by Lieutenant General of the Ordnance,

28th February, 1855 $\frac{M}{1218}$.

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9. New arrangement in Packing Small Arm Ammunition in Wagon Boxes.

Recommended by the Select Committee.

Approved by Lieutenant General of the Ordnance,

5th March, 1855.

10. Bothway's Blocks.

Proposed by Mr. Bothway.

Recommended by the Select Committee.

Approved by Lieutenant General of the Ordnance.

23rd March, 1855 $\frac{M}{1267}$.

11. New Stretcher for use of an Army in the Field.

Proposed by Captain Clerk, R. A.

Recommended by the Ordnance Select Committee.

Approved 9th May, 1855 $\frac{M}{1339}$.

12. Loading Hole for Bullets in old pattern.

Shrapnel Shells to be fitted with a Metal screwed Plug, instead of Wood.

Ordered 9th May, 1855 $\frac{L}{329}$.

13. Charges of Powder for 68 and 56 Pounder Guns, reduced 2 lbs.

Recommended by the Select Committee.

Approved 11th May, 1855 $\frac{M}{1309}$.

14. Spring Spikes.

Proposed by Captain Clerk R. A.

Recommended by the Ordnance Select Committee.

Approved 14th May, 1855 $\frac{M}{1337}$.

15. Alterations in the Axle-tree Arms and Pipe-boxes of Field and Travelling Carriages as follows:—

I. One Axletree Arm and Pipe-box for all Field Guns and Carriages.

II. The Axletree arm to be that known at present as the Heavy 6-Pounder or 9-Pounder Axle-tree.

III. That the Axle-tree arm should be shortened 1 inch to prevent its interfering with the present length of splinter-bar; the Pipe-box to be also shortened 1 inch.

IV. That one Axle-tree arm and Pipe-box be adopted for the 24 and 18-pounder (iron) Guns, mounted on Travelling Carriages—viz., the 24-pounder Gun,—carriage Axle, which, with the Pipe-box is to be shortened 2 inches.

Proposed by Colonel Tulloh, R. A.
Recommended by the Ordnance Select Committee.
Approved 26th May, 1855.

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16. Dispart sight on Muzzle of all Field Guns.

Proposed by Captain Burrows, R. A.
Recommended by the Ordnance Select Committee.
Approved 19th July, 1855 $\frac{S}{7067}$.

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17. A Bullet with an iron cup to be substituted for the Pritchett's Bullets, for rifle pattern, 1853, until arrangements can be made to fit them with a wood plug.

Approved 7th June, 1855 $\frac{C}{984}$.

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18. Iron Mortars in future to be cast without Vent Fields.

Proposed by Lieutnant Colonel Eardley Wilmot R. A.
Approved 19th July, 1855 $\frac{S}{7067}$.

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19. Harnes (new pattern) Royal Artillery.

Approved 16th August, 1855 $\frac{D}{1184}$.

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20. New Siege Platforms.

Proposed by Captain Clerk, R. A.
Recommended by the Ordnance Select Committee.
Ordered to be sent to the Crimea,
14th August, 1855, $\frac{S}{7306}$, and 17th August, 1855, $\frac{C}{4535}$.

21.

I. Wood Fuzes to be made with larger Cone.

II. Bottoms fixed to shells by Gun-metal Rivets instead of Tin straps.

III. Metal Cap for Wood Fuzes instead of Paper or Canvas.

IV. 12-Pounder Common Shells to be cast with a Lip.

Proposed by Captain Boxer, R. A.
Recommended by the Ordnance Select Committee.
Approved 18th August, 1855 $\frac{M}{1561}$.

22. Colored Paper for Rifle Musquet Ammunition.

Pattern (1851)........................Red.
Pattern (1842)........................Yellow.

Approved 17th September, 1855 $\frac{C}{1297}$.

Account of Alterations and Additions in Ordnance Carriages, &c. adopted in the Service since the last Return.

War Department,
Pall Mall.
30*th June,* 1856.

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1. Guns under Proof Trial, to rest on their trunnions, on suitable carriages made for the purpose.

Recommended by the Ordnance Select Committee.

Approved 16th August, 1855.

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2. Bursting Charges for 13-inch Shells to be 10 ½ lbs.

Reduced charges of bursting powder to be used when circumstances render it desirable.

Proposed by Captain Boxer, R. A. Recommended by the Ordnance Select Committee.

Approved 20th August 1855.

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3. Cappe's Patent Daylight Reflectors for Powder Magazines, under circumstances where their use may be deemed desirable.

Proposed by Messrs. Cappe and Co. Recommended by the Ordnance Select Committee.

Ordered 29th August, 1855 $\frac{M}{1738}$.

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4. Copper Bouches, to be used for the Vents of Iron Guns in future.

Recommended by the Ordnance Select Committee.

Approved 27th September, 1855 $\frac{S}{7798}$.

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5. Spike in cover of Metal Fuze, for Naval Service, discontinued by order of the Lords Commissioners of the Admiralty.

Notified 1st November, 1855 $\frac{A}{2646}$.

6. Wood Bottoms for Shrapnel Shells, to be fixed by means of a rivet.

Proposed by Captain Boxer, R. A. Recommended by the Ordnance Select Committee.

Approved 19th December, 1855 $\frac{8}{8516}$.

7. Charges of 8 lbs. of Powder to be used for Grape, Case, &c., at close quarters; for the 10-inch Gun constructed by Major General Chalmer.

Ordered 2nd January, 1856 $\frac{8}{6106}$.

8. Lewis-holes, adopted in all Mortar Shells of large size.

Proposed by Captain Boxer R. A. Recommended by the Ordnance Select Committee.

Approved 17th January, 1856 $\frac{137\ B.}{6.}$

9. Charges for Sea Service 68-pounder, 95 cwt. Gun to be as follows;—

16 lbs. for distant charge
12 lbs. for full ,,
8 lbs. for reduced ,,

Ordered 28th January, 1856, z. $\frac{565}{1}$.

10. Alterations in the Felloes and Tenons of Spokes for Wheels.

Proposed by Captain Clerk, R. A. Recommended by the Ordnance Select Committee.

Approved 31st January, 1856 $\frac{137{\cdot}C}{10}$.

11. Carcases, 5½ inch, maximum charge to be 6lbs., and to be fitted with wood bottoms.

Proposed by Captain Boxer, R. A Recommended by the Ordnance Select Committee.

Approved 5th February, 1856 $\frac{137.B.}{2}$.

12. Metal Screw Plugs for Loaded Shells.

Live shells supplied to Field Batteries to be so fitted.

Plugs with Gutta Percha Wads to be supplied with all

Shells (Common, Shrapnel, and Mortar) issued for Garrison and Siege Service.

Proposed by Captain Boxer, R. A. Recommended by the Ordnance Select Committee.

Approved 21st February, 1856 $\frac{137 \cdot B.}{31}$.

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13. New Method of Igniting Signal and Long Lights, for Land and Sea Service.

Proposed by Captain Boxer, R. A. Recommended by the Ordnance Select Committee.

Approved 1st January, 1856, $\frac{8}{8583}$, and 3rd March, 1856 $\frac{275}{38}$.

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14. All Tangent Sights for use on Board Ship, to be marked in yards, and to be six sided.

Proposed by Captain Sir T. Maitland. C. B. R. N.

Ordered 10th March, 1856 $\frac{P \cdot 157}{9}$.

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15. Wood Bottoms, open in centre. Proportions of one-fourth of all shells supplied for sea service to be fitted in such manner, for the purpose of using when shot and shell are fired together.

Proposed by Captain Sir T. Maitland, C. B., R. N.

Approved 20th March, 1856 $\frac{275 \cdot 23}{25}$.

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16. Step for Siege Carriages, to facilitate the working and serving of heavy Guns mounted thereon.

Proposed by Major Taddy, R. A. Recommended by the Ordnance Select Committee.

Approved 12th May, 1856 $\frac{137 \cdot T}{24}$.

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17. Wheel Barrows. Wrought Iron Wheels instead of Cast. Elm sides instead of Deal, and wrought Iron Stays.

Orders, 6th August, 1855 $\frac{F}{50}$.
5th December, 1855 $\frac{W}{375}$.
20th December, 1855 $\frac{M}{626}$.

W. Cator,
D. G.

A Trial of Addison's Furnace took place before the Committee On the 17th September 1852.

The grate was laid with shavings, common coal, and coke, and after being lighted 20 minutes fifteen 32-pounder shot were placed on the bars.

In one hour after lighting, the shot next to the door were taken out serviceably hot, and in one hour and a quarter the whole were red hot; thus completely verifying the time of heating, as reported by the Select Committee on this subject in May 1846.

At intervals of 20 minutes each the fire was stirred, and a little coke and coal added.

When the furnace was at its full heat, 3 cold shot were introduced, and in 10 minutes these were serviceably hot, and in 15 minutes red hot.

The fuel expended, and which kept the shot red hot three hours after the time already noted, (the damper being closed,) was—

2 bushels of coke
½ bushel of coal
½ bushel of shavings
½ bushel of small wood

Deputy Adjutant General's Office,
Woolwich, 18*th May*, 1855.

GENERAL ORDER.

The following alterations in Charges and Elevations of Heavy Guns have been proposed by the Inspector of Artillery, recommended by the Select Committee, and approved by the Lieutenant-General of the Ordnance:—

Firstly. The Charges of the undermentioned Guns, to be reduced 2 lbs each, viz:—

68 Pounders, of 112 cwt., from 20 lbs. to 18 lbs.
68 Pounders, of 95 cwt., from 16 lbs. to 14 lbs.
56 Pounders, of 97 cwt., from 16 lbs. to 14 lbs.
56 Pounders, of 85 cwt., from 14 lbs. to 12 lbs.

Secondly. No piece of Ordnance exceeding 10 Calibres to be fired with more than 12° Elevation, it being, however, understood that the Commanding Officer may use discretionary power in deviating from this rule when peculiar circumstances on actual service may seem to require it.

H. PALLISER,
Assistant Adjutant General.

This Order is not intended to govern Naval practice.

Confidential Circular.

ABSTRACT
OF
Recommendations and Observations taken from a Report of a Committee of Officers of the Royal Artillery and Royal Engineers appointed by the Master General of the Ordnance, to consider what may be the best arrangements under ordinary circumstances for Coast Batteries: Reported 5th November 1853, and approved by the Master General and Board 28th January 1853 $\frac{M}{612}$.

No. 1.—*Nature of Ordnance.*

Nature of Ordnance.

1st. The accompanying table to be substituted for the table sanctioned on 22d January 1844, of ordnance to be used generally in the armament of forts, towers, and batteries.

8 inch shell gun and 32-pounder of 56 cwtt.

2d. The 8-inch shell gun and the 32-pounder of 56 cwts. are considered the best adapted for coast defence generally, both being capable of setting fire to shipping; the former by shells, the latter by hot shot. The relative proportions of these guns to be employed on ordinary occasions is one third of the former and two thirds of the latter. Where practicable, it will be advisable to place the different natures in different batteries, but when mounted on the same battery the shell guns should be placed to the prevailing windward, the shot furnace to leeward.

3d. Where a point of great importance is to be defended, and a more than usually heavy fire is requisite, the 10-inch shell gun is applicable.

10-Inch shell gun.

4th. At great roadsteads, or for enfilading channels requiring longer ranges than ordinary, a proportion of 68 pounders to be employed.

68-pounder gun.

5th. In batteries where the command extends over a short range the lighter guns and howitzers may be employed, as less costly and quicker served.

Lighter Guns of similar Calibre.

6th. The 24 pounder gun is retained both as a siege gun and for coast batteries protecting a shallow beach.

The 24-pounder gun.

No. 2—Carriages and Platforms.

1st. The common garrison carriage is to be retained in the service.,

Common garrison Carriages.

2d. The platforms of the British service may be classed under five heads; viz.

Platforms.

1. The common ground platform of wood or stone,
2. The Madras platform.
3. The dwarf traversing platform and sliding carriage.
4. The casemate ditto ditto
5. The naval slide and ditto

The choice of these, or of any other form of construction, must depend upon locality and the nature of the service required; but the platforms in use appear to be capable of realizing all that may be desired, excepting always the proximity of an enemy's ship of the line within 400 yards, in which case it would seem to be necessary, with our present means of cover, either to retire the battery from the shore, or to place it at an elevation not to be reached by direct fire. Supposing the enemy to elevate his guns 10°, and the height of his guns on the main deck to be 16 feet, the required elevation of the battery for the distance of 400 yards would be 224 feet, for 500 yards 260 feet,

Choice of Platforms.

and at 600 yards 305 feet. This is shown to exemplify the fact,—not for the purpose of recommending so great a height for batteries, as the lower the battery, so as not to be exposed to ricochet fire, the more efficient it will prove.

Common ground platform.

1st. Where rapidity of fire is not needed, the common ground platforms may be used, either for garrison, sea service, or siege carriages.

Madras platform.

2d. The Madras platform is chiefly applicable to 24-pounders or light 32-pounders for siege purposes, but on some occasions it may be useful for the 32-pounders of 56 cwts. and the 8-inch shell gun of 65 cwts.

Dwarf platform.

3d. The advantages of the dwarf over the common traversing platform are so great, that the supply of the latter is to be discontinued. This dwarf platform, by means of raised racers, gives the power of firing guns over every height of parapet with greater facility.

Casemate platform.

4th. The casemate platform differs from the dwarf only by the removal of the fore-trucks and rear-blocks.

Naval slide.

5th. Of the naval slide it may be sufficient to state, that, when available for service on shore in an emergency, it presents a very valuable resource either in defence or attack. By means of the compressor, the gun may be worked without a breeching; though if circumstances permit, it will be preferable to raise the slide or chocks, or by means of coins, to such a slope as to dispense with the compressor.

Two sleepers and a small dead block are all that besides are necessary, and, in case of need, a stout crowbar backed with pickets will serve as a pivot.

The naval carriage and slide, and the dwarf and casemate carriages and platforms, are of the same width, and can be used on each other as occasion may require, the land service 56-pounder excepted, of which, for the sake of stability, the width between the sides is increased from 21 to 26 inches. In platforms *en barbette* it may be proper to retain this dimension, but for all low platforms of all natures the width of 21 inches may be considered sufficient.

Cover for guns.

On the question of cover for guns and carriages from the enemy's fire, it may be observed, that nearly sixty years back Montalembert, in his "Art Defensif," &c., pointed out, that by having the pivot of the traversing gun in the middle line of the embrazure under the muzzle of the gun, and as near to the exterior surface of the scarp as the gun would reach, the throat of the embrazure, and its external aperture, for a given amplitude, might be reduced to the smallest dimensions possible, with the further effect that when run out, the gun itself would block the embrazure against the entrance of any large projectile. The principle has been acted upon in Sweden and in the United States, and is no doubt capable of a much larger developement than it has yet received.

No. 3.—Iron Carriages and Platforms.

Iron carriages and platforms to be changed for wood at the discretion of the local authorities.

1st. In reference to iron carriages, the order of 22d January 1844 directs, that in every strong place a sufficient number of wooden carriages shall be in store to be employed on the weaker fronts; but the question of withdrawing any iron carriages, and replacing them at once, in such situations as may be desirable, with wooden ones, is now left at the discretion of the local authorities. On this proposition Lord Hardinge's minute is as follows: "No objection, provided their (the "commanding officer's) attention be called to these points, "and I should recommend that every Officer of artillery, one "month after he assumes the command, should be required "to make a report of the armament under his charge,—whe- "ther the armament is complete, the expense magazines in "order and readily available, so that the Director General "may have the views and opinions of different officers as to

" the state of the batteries, and decide if he thinks proper, " by a personal examination of the batteries himself."

As it may be difficult at all times to carry this out in a short space of time, the points alluded to by his Lordship will in future be noticed in the annual inspection reports.

Iron traversing platforms.

2d. The Committee consider that there are some situations in which the iron traversing platforms may be retained in the service, but not where liable either to close direct fire or to enfilade, or where seriously exposed to the effect of shells.

Recoil of iron upon iron.

3d. In recent equipment it has been provided that iron carriages shall not be placed on iron traversing platforms, in order to prevent the excessive effects of the recoil. This regulation in future to be general.

4th. No more iron carriages and platforms to be constructed.

No. 4.—*Parapets, Embrazures, and Casemates.*

1st The low *barbette* battery should only be adopted when the work is fifty or sixty feet above the level of the sea, safe from enfilade, and where the enemy cannot come to close quarters. It affords great sweep of range, and the guns might be mounted on common garrison carriages or on dwarf platforms.

2d. If the battery is less elevated, or its flanks insecure, the parapet to be heightened and the guns mounted on dwarf platforms; but where from the nature of the ground it may be necessary for protection to have a higher parapet, the dwarf platform on raised racers will be required; in both cases with or without traverses.

3d. Embrazures weaken parapets, and have a tendency to draw the enemy's shot into the battery, but they are, nevertheless, eligible for situations requiring only a direct fire, or a lateral range of not more than 60°.

4th. Casemate batteries may be necessary where the space for the battery is small and a double tier of guns may be required for defence. On low grounds, and near deep water, the upper tier should be *en barbette* on dwarf platforms.

Interior space.

5th. Eighteen to twenty feet in embrazures, measured from centre to centre, should be the minimum distance for heavy guns, and twenty-five to 30 feet on traversing platforms with extensive sweeps.

No. 5.—*Position and Height of Guns, as regards the Water, and the service to be performed by the Battery.*

Ships should be assailed at distances before allowed to anchor off a battery.

1st. The rules for the relative heights and positions of Guns appear to be clearly laid down in the "Aide Mèmoire" and "Engineer Papers," the former by M. General Lewis, and the latter by Sir John Burgoyne, and to be concurred in by Sir Howard Douglas in the last edition of his "Naval Gunnery." In the latter work, at page 443, &c., are the following passages: "If ships be permitted with impunity to measure well their distances from a fortress, and then deliberately open their fire, the torrent of iron which they may throw in must be irresistable and overwhelming, especially if the batteries are placed *a fleur d'eau,* and consequently commanded by the upper decks of ships."

"Batteries placed nearly on a level with the water are far more subject to the fire of ships, and are much less formidable to them, than Batteries elevated somewhat above the level of the sea. These last command the upper deck of a ship by a direct though depressed fire, which will penetrate obliquely into and through her sides, and possibly come out below the water line; whereas shot, even the best directed, from the ship, will, except such as may chance to enter the embrazures, in grazing the crest of the parapet pass over the heads of the defenders in the battery without doing any material harm. Should any guns be mounted *en barbette,* which ought never to be the case in sea batte-

Batteries to be placed above the line of a ship, so that they may not be exposed to ricochet, though the ship will be at angles of from 3° to 4°.

" ries intended for close or flanking defences, they would inevitably be dismounted. No ricochet from a ship can touch a battery in a commanding position; whilst, unless the battery be so high that its shot would strike the water under angles exceeding 3° or 3½°, the ship will be struck, either intentionally or accidentally, by shot ricocheting on the water. In the 'Aide Mèmoire Navale' it is stated, p. 404, that the height of a coast or land battery above the level of the sea should be from ten to fifteen metres (yards), because that height will permit the ricochet to take effect as far from the battery as 200 metres (yards) and will avoid the effect of the ricochet of shot fired from ships decks, which are only from five to six metres above the water line."

Tide is to be considered in the estimate of the height of a battery.

" It is not easy to assign any general rule for the most advantageous height of a battery above the level of the sea, because that level alters with the tide; the height should also depend on the degree of proximity to which vessels may, from their draught of water, approach to attack. It may be stated in general that all batteries should have some command over the body fired at.

No. 6.—Expense Magazines and Shell Rooms.

Metal lined cases.

1st: The metal-lined case now in use for the navy to be in future adopted in the land service, which contains 120 lbs. of powder in cartridges of 15 lbs., and as follows for different charges:

10-inch gun	12 lbs.	9 cartridges.
68-pounder gun	20 lbs.	5 do.
8-inch gun	10 lbs.	11 do.
8-inch gun	6 lbs.	19 do.
56-pounder gun	14 lbs.	8 do.
32 ,, ,,	10 lbs.	11 do.

32-pounder gun	8 lbs.	14 cartridges.
32 ,, ,,	6 lbs.	19 do.
8-inch howitzer	4 lbs.	27 do.

These cases to be used as substitutes for portable magazines.

When luted they are perfectly water-tight, and very portable. It is presumed there are few or no batteries without proximate expense magazines, so that it is advisable to keep the cases in them, and when required, two men can easily transport them from thence to the batteries.

Expense magazines to be placed between the magazine and battery in the most suitable spot.

Receptacles, on the principle suggested by Sir John Burgoyne, as expense magazines, to contain two or more cases for immediate use should be placed somewhere between the magazine of the battery and the guns; and the Committee consider the slope or the foot of the rampart in rear of the guns to be a more secure, as well as more convenient situation for these expense magazines, than in the parapet or the merlon, where there would be more danger of explosion, and the consequences would be more serious.

In the latter position, if two guns were to be supplied from the same receptacle, the cartridge for the left hand gun would be carried round the rear of its platform in order to be placed in the hands of the man who loads the gun.

To avoid confusion, the supply for the gun should, if possible, be from its own rear, but the Committee consider that the best position for these expense magazines must depend on local circumstances.

Expense shell rooms required near the magazins, also room for stores.

Expense shell rooms are necessary whether or not percussion fuzes are employed, time fuzes and shrapnel shells in particular will require adjustment for guns in action. These shell rooms should be placed adjoining to the small expense magazines proposed in the foregoing article, but separated from them by at least a strong partition.

They should be made capable of containing a certain number of shells (to be hereafter determined) for each gun, filled, and with fuzes either fixed or unfixed, according to the kind employed.

Space in them should also be provided, with tables or benches, for filling and fixing, a further supply of shells, and a small recess for containing bursting charges, fuzes, &c.

Magazine of the battery should hold 200 rounds per piece in general: Expense Magazine, 12 rounds per piece in metal lined cases.

The magazine of the battery should be capable of containing at a maximum 200 rounds per gun; the object of the work must determine the exact number of rounds to be provided. The magazine should be as near to the battery as possible, in the safest situation that can be selected; and, if very near, twelve rounds per gun in the expense magazines for immediate use may be sufficient, or the expense powder magazine might be dispensed with, and one case at a time carried out for each gun with great facility.

Shell store.

The shell store should be adjacent to the battery magazine; and the Committee recommend an arrangement of shelves round the walls for the lodgment of these projectiles,

Shelter from the weather is also required for spunges, handspikes, &c, and also for the shot furnace.

No 7.—Proportion of Ammunition.

Ammunition

The general proportion of made-up ammunition for coast batteries to be as follows:—

For solid shot guns............ 150 } rounds per gun in the
For shell guns.................. 120 } battery, and a reserve
of 100 rounds per gun, also made up.

The position of the reserve supply must depend on the military posts in the neighbourhood, and transport should be available at hand for removing it, either in advance or retreat.

The more important works may have a larger proportion, and in the less important a diminished provision may be sufficient.

The relative proportions of the different kinds of ammunition in the batteries to be as follows:—

For solid shot guns	10	common case.
	10	grape.
	20	shrapnel.
	20	common shells.
	90	round shot.
Total...	150	rounds.
For 8-inch shell guns	10	common case.
	10	grape.
	20	shrapnel.
	80	common shells.
Total...	120	rounds.
For 10-inch shell guns	10	common case.
	10	grape.
	100	common shells.
Total...	120	rounds.

The shells in the expense shell rooms, if 8 or 10-inch, to be kept in the naval shell boxes, one for each; if 32-pounder shells, in the boxes of the land service, holding 4 shells each.

The external dimensions of these boxes for packing are.

8-inch boxes (one shell)....	length	11¼	inches.
	width	10¼	,,
	depth	11¼	,,
10-inch boxes (one shell)....	length	13¼	,,
	width	12¼	,,
	depth	13¼	,,
32-pounder (4 shells).........	length	29⅝	,,
	depth	12	,,
	width	8½	,,

Twelve boxes for 8 and 10 inch shells for each gun, and three boxes for 32-pounders, should also be retained in the shell store as vehicles for keeping up the supply to the expense magazines.

Rockets.

A proportion of 12-pounder rockets with long tubes to form part of the armament of coast defences where an enemy can approach near to the shore, or to protect beaches where he might attempt to effect a landing; and it is suggested that for this latter object, small flêches might be provided at intervals along the shore, to afford cover for rocket batteries to be attached to the moveable force destined to oppose a descent. These might in many instances supersede the necessity of constructing fixed small batteries.

Cover for rocket batteries

Time-firing

The annexed diagram, Plate 5, drawn by Captain Clerk R. A., shows that a steamer passing in front of a Battery at a distance of 500 yards from the shore, and moving at the rate of 12 miles an hour, and supposing that a fire may be kept up at one round per minute, may be struck five times by every gun that has a sweep of 120°.

From the same diagram, by easy calculation, may be ascertained the number of shot that might be delivered at any other distance, rate of steaming, or lateral range of guns.

No. 8.—*Shot Furnaces.*

Addison's furnace for heating shot, as improved after a course of experiments, is to be used in the service.

The details of the last trials are as follows:—

The grate was laid with 2½ lbs of shaving, 20 lbs, of soft wood, and 30 lbs of hard wood.

Fire lighted at 10 h. 15 min.

15-32-pounder shot put in at 10 h. 35 minutes.

2 shot taken out at 11 h. 15 min., serviceably hot, and lighted powder immediately.

3 shot taken out at 11 h. 30 min., red hot, and 5 shot put in to replace the 5 taken out.

2 of these last taken out at 11 h. 45 min., serviceably hot, lighting powder in three seconds, and shavings in 3 minutes.

The shot taken out at 11 h. 15 min. ignited powder at 12 h.

Quantity of wood used was,

170 lbs. of hard wood.
40 lbs. of soft wood.
2½ lbs. of shavings.

The shot left in the furnace were red hot at 1 o'clock, but the fire was nearly out. At 2 o'clock the shot were removed from the furnace, and were not then serviceably hot.

The shot should be placed in the furnace at the *front*, and removed by the *rear* door.

WOOLWICH,
17*th February* 1853.

W. CATOR,
D. G.

Table of the Pieces of Iron Ordnance which are to be used in the Armament generally of Works, Forts, Towers and Sea Batteries.

	Nature of Ordnance.	Length.		Weight.	Charge lbs with			Range with shot.				Remarks.
					Shot.	Shells.						
						Common	Shrapnel	2°	5°	8°	12°	
		Ft.	In	Cwt				Yds	Yds	Yds	Yds	
1	68 Pdr. gun....	10	10	112	20	10	6	1400	2240	2840	3400	Solid shot, shells, shrapnel shells, Grape shot and case.
	do.	......		95	14	...	...	1070	1984	2540	3289	
2	10 inch shell gun	9	4	86	12	12	...	970	1690	2100	2500	Hollow shot, shells, Grape shot, and case.
3	8 Inch shell gun	9	0	65	10	10	6	1130	1920	2400	3010	Hollow shot 56 lbs, shells, shrapnel shells, Grape shot and case.
4	8 Inch shell gun............	8	0	52	8	8	6	825	1460	1900	...	Hollow shot 56 lbs, shells, shrapnel shells, Grape shot and case.
5	32 Pdr. gun....	9	6	56	10	8	6	1130	1964	2465	3030	Solid shot, shells, shrapnel shells, Grape shot and case
6	32 Pdr. gun....	8	0	42	6	6	6	1100	1780	2320	2910	Solid shot, shells, shrapnel shells, Grape shot and case.
7	32 Pdr. gun....	6	0	25	4	4	4	720	1380	1780	...	Solid shot, shells, shrapnel shells, Grape shot and case.
8	24 Pdr. gun....	9	6	50	8	...	5	1100	1850	2240	2630	Solid shot, shrapnel shells, Grape shot and case.
9	24 Pdr. gun....	6	0	20	2½	2½	2½	750	1280	1750	2200	Solid shot, shells, shrapnel shells, Grape shot and case.
10	18 Pdr. gun....	9	0	42	6	...	4½	1050	1770	2230	2820.	Solid shot, shrapnel shells, Grape shot, and case.
11	12 Pdr. gun....	6	0	21	4	3	3	1020	1650	1980	2500	Solid shot, shells, shrapnel shells, Grape shot and case,
12	6 Pdr. gun....	6	0	17	2	...	2	940	1470	1880	2400	Solid shot, shrapnel shells, Grape shot and case.
13	10 Inch Howr.	......		41	...	7	...	650	1100	1770	2410	Shells and case shot.
14	8 Inch Howr.	......		21	...	4	...	600	1000	1650	2000	Shells and case shot.
15	13 Inch Mortar	......		36	...	9	...	Extreme range			2900	Shells and carcasses.
16	10 Inch Mortar	......		18	...	4	...	Extreme range			2400	Shells and carcasses.
17	8 Inch Mortar	......		9	...	2	...	Extreme range			2000	Shells and carcasses.

Note.—Charges for Shrapnel Shells altered, vide Table A page 31.

N. B.—The undermentioned Natures of Ordnance, of which a store still remains are to be kept in view, that they may be brought into use in works suitable for them.

Nature of Ordnance.	Length.		Weightt	Charge lbs. with.			Ranges with shot.				Remarks.
				Shot.	Shells.						
					Common.	Shrapnel.	2°	5°	8°	12°	
	Ft.	In	Cwt				Yds	Yds	Yds	Yds	
8 Inch shell gun.	6	8½	50	8	8	6	1050	1800	2250	2870	Hollow shot, shells, shrapnel shells, grape and case.
56 Pounder gun..	10	0	85	14	10	6	1310	2100	2585	3270	Solid shot, shells, shrapnel shells, grape and case.
42 Pounder gun..	10	0	84	14	10	6	1340	2050	2590	3200	
42 Pounder gun..	10	0	75	12	10	6	1310	2020	2560	3170	
42 Pounder gun..	9	6	67	10½	10	6	1120	1865	2506	3100	
32 Pounder gun..	9	7	63	10	8	6	1350	1990	2340	3030	

WOOLWICH,
19*th* *January* 1853.

W. CATOR,
D. G.

Cubic Measurement of Boxes for Strapped Ammunition for different natures of Ordnance.

Nature of Ordnance.	No of Round shot and shells.	Number to be boxed.					No. in each box.		Dimensions of Boxes.						Cubic measurement in feet.		
									For shells.			For case and grape.					
		Common shells.	Shrapnel shells.	Grape.	Case.	Total.	Shells.	Grape and case.	Length.	width.	depth.	Length.	width.	depth.	Shells.	Case and Grape.	Total.
10 Inch shell gun........	120	50	..	10	10	70	1	2	13¼	12¼	13¼	25¼	12¼	13	62	24	86
8 Inch shell gun........	120	30	20	10	10	70	1	3	11¼	10¼	11¼	28¾	10¼	15¼	38	19	57
68 Pdr. Gun.............	150	20	20	10	10	60	1	3	11¼	10¼	11¼	28¾	10¼	15¼	31	19	50
42 Pdr. Gun.............	150	20	20	10	10	60	4	4	31¾	9	15½	31¾	9	15½	26	13	39
32 Pdr. Gun.............	150	20	20	10	10	60	4	4	29⅝	8½	12	29⅝	8½	12	18	9	27

The cartridges for the foregoing guns are to be filled and packed in metal lined cases, the dimensions of which are,—

Length, 17½ Inches.
Width, 16 Inches.
Depth, 21 Inches.

oolwi

mon

hragm

Length, 17½ Inches.
Width, 16 Inches.

Directions for fixing Wood Bottoms to Common Shells, and for loading and preparing for Service, Diaphragm and Common Shells. Plate 6.

Fig.	REFERENCES.
1.	Common Shell empty, with wood bottom ready for fixing.
2.	Rivet for fixing wood bottom.
3.	Diaphragm Shell loaded and secured with metal plug.
4.	Metal Plug for fuze hole.
5.	Common Shell loaded and secured with metal plug.
6.	Screw Metal Plug for loading hole of Diaphragm Shell.
7.	Gutta Percha Wad for ditto ditto.
8.	Gutta Percha Wad for Common Shell.
9.	Wood Drift for putting wad into Diaphragm Shells.
10.	Punch for riveting bottoms.
11.	Wood Drift for putting wad into Common Shells.
12.	Key for screwing and unscrewing Metal Plug.

COMMON SHELLS.

For *Field Service* Common Shells are issued loaded, having the fuze-hole secured as shown in fig. 5 by a gutta percha wad *(g)*, and a metal plug *(a)* with a gutta percha collar. The plug and gutta percha wad, if properly fixed in the shell, completely protect the powder from fire or water.

For *Garrisons and Outstations* Common Shells are issued empty with the proper complement of bursters, together with the necessary implements &c., for loading, securing, and preparing for firing, viz:—Copper Funnel for loading with powder, Metal Plug (fig. 4), Gutta Percha Wad (fig. 8), Wood Drift (fig. 11) for putting wad into fuze-hole, and

Key (fig. 12) for screwing and unscrewing Metal Plug in fuze-hole.

A small percentage of empty Common Shells are supplied, without the bottoms attached, to Garrisons and Out-stations—these may be piled the same as solid shot; the wood bottoms, rivets, and the punches for fixing them being issued separately, and for which store room must be provided. Those stations must also be provided with a strong wooden block or table, having on the top a small cavity, in which the shell may be kept steady during the operation of fixing the wood bottom. The small hole in the shell for the rivet is filled with grease, and the fuze-hole is closed with a cork which has been saturated with beeswax.

N. B.—In piling those shells the fuze-holes are to be placed downwards.

For *Boat service in the Navy* Common Shells are issued empty, with the proper complement of bursters &c.

DIAPHRAGM SHELLS.

For *Field and Naval Service* Diaphragm Shells are issued loaded, having the fuze-hole secured as shown in fig. 3 with a wood plug covered with serge (*f*), and a metal plug (*a*), with gutta percha collar, and the loading hole secured with a gutta percha wad (*g*) and screw plug (*b*).

N. B.—The plug covered with serge should never be taken out of the fuze-hole until the fuze is ready to be inserted in its place—this is necessary in order to prevent any large quantity of the powder passing through the small hole (*m*) in the socket (*e*) into the fuze-hole, and thereby filling it so as to prevent the fuze being "set home;" but a few grains only of powder at the bottom of the fuze-hole, though not absolutely necessary, are more an advantage than otherwise when the fuze is inserted.

To *Garrisons and Outstations* Diaphragm Shells are issued empty, with the proper complement of bursters, and the necessary implements for loading, &c., consisting of Copper Funnel, Wood Drift (fig. 9), Gutta Percha Wads (fig. 7), Screwdriver for unscrewing and screwing plug in loading hole, and Key (fig. 12) for metal plug.

Each shell has the fuze hole secured with the wood plug covered with serge, and the metal plug and gutta percha collar; and the loading hole is closed with the screw plug (fig. 6.)

N. B.—Many of the first issues of the Diaphragm Shells were supplied by contract during the war, and it being almost impracticable at that time to thoroughly examine them, it is advisable previous to loading these shells to ascertain, when the screw plug (*b* fig : 3) is taken out, whether any loose coal dust is in them, if so it should be poured out by the loading hole before putting in the powder.

DIRECTIONS FOR FIXING WOOD BOTTOMS TO COMMON SHELLS.

Place the Shell on a block of wood (*t*) as shewn in Fig : 1 with the rivet hole uppermost, from which the grease must be entirely removed ; put the rivet (*r*) in the hole made for it in the wood bottom (*w*), and pressing the finger on the head of the rivet, place the bottom on the shell, moving it about until the rivet falls into the hole, then put the punch (fig : 10) on the head of the rivet and strike it a few smart blows with a hammer until the bottom is firmly fixed to the shell.

DIRECTIONS FOR LOADING COMMON SHELLS.

Remove the cork from the fuze hole, place the shell in the shell box, and by means of a copper funnel pour in the bursting charge. Carefully wipe every portion of powder from the fuze hole, and drive in a Gutta Percha Wad (*g* fig : 5) with a Wood Drift (fig : 11) which has a shoulder to limit the depth, then screw in the Metal Plug (*a*) which is fitted with a gutta percha collar: the Key (fig: 12) for this purpose being placed in the holes *h h* in the plug.

DIRECTIONS FOR PREPARING COMMON SHELLS FOR FIRING.

Unscrew the metal plug with the key, insert the fuze prepared for the range required, and set it home with a mallet and setter.

N. B.—The Gutta Percha Wad is driven into the shell in the operation of fixing the fuze.

DIRECTIONS FOR LOADING DIAPHRAGM SHELLS.

Every shell, filled or empty, must have a wood plug (*f* fig. 3) covered with serge placed in the socket (*e*,) so as to prevent the powder from passing through the small hole (*m*) into the fuze hole, which is further secured by the metal plug (*a*) and gutta percha collar.

Place the shell (fig. 3) with the loading hole uppermost on a piece of bevelled wood fixed on a table, at an angle of 45°, unscrew the metal plug (*b*) from the loading hole, and with a small funnel pour in the bursting charge, shaking the shell until the whole of the powder is in, then remove the funnel. Carefully wipe every portion of gunpowder from the hole, and put in a Gutta Percha Wad (*g*) with the Wood Drift (fig. 9,) and with a feather slightly oil both hole and metal plug, and screw in the latter.

DIRECTIONS FOR PREPARING DIAPHRAGM SHELLS FOR FIRING.

Unscrew the Metal Plug (*a*) with the Key (fig. 12,) and remove the flannel plug by the string, then insert the fuze, and " set" it home with mallet and setter.

Common and Diaphragm Shells, when supplied empty, have the proper complement of Bursters issued with them, together with all the necessary Implements, &c., for loading the shells, securing them for travelling, and preparing for firing.

Implements, &c., supplied for loading.

	Per Troop or Battery.
Funnels, Copper	2 per gun.
Drifts, Wood for driving Gutta Percha Wad into Diaphragm shell	2 ,,
Do. Do. Common shell ...	2 ,,
Keys for screwing and unscrewing Plug for Fuze hole....	2 ,,
Screw drivers	2 ,,
Wads, Gutta Percha, for loading hole of Diaphragm shell	5 per cent more than Shells.
Do. Do. for fuze hole of Common Shell	
Plug, Metal Screw, for loading hole of Diaphragm Shell	
Do. for fuze-holes of all shells.	

(MEMO.)

The fuze holes of all shells used with Boxer's Fuze *must* be made to the following dimensions, viz:—

		Depth Inches	Top Diameter. Inch	Bottom Diameter. Inch
Mortar.	13 Inch	2·146	1·484	1·25
	10 Inch	1·646	1.484	1·309
	8 Inch	1·39	1·411	1·259
Common.	10 Inch	1·646	1·023	0·848
	8 Inch	1·39	1·023	0·875
	32 Pounder	1·084	1·023	0·913
	24 Pr. or 5½ In.	0·936	1·023	0·925
	18 Pr.	0·803	1·023	0·937
	12 Pr. or 4⅖ In.	1·65	1·023	0·848

A few sets of Tools and Gauges for adjusting and roughing the Fuze holes were supplied with the Machinery forwarded to India some time ago. If the Machinery be not in operation, the Tools can be readily worked by hand.

In order that the same Fuze may be used for all natures of Common Shells fired from Guns and Howitzers, from the 10 Inch to the 4⅖ Inch, it is necessary that the bottom of the Fuze hole of the 4⅖ Inch be not greater than 0·848 inch, or the explosion of the bursting charge will not in all cases fracture the shell. At present the Fuze holes of the 4⅖ Inch shells are bushed with a gun-metal socket 1·65 inch in length, so as to bring the bottom of the Fuze hole to the required dimensions.

(100-3-11-57 R. L. 423.)

Memo. of the quantity of Powder for bursting the respective natures of Diaphragm Shells, and Improved Shrapnel Shells; as fixed by the Authorities at Woolwich.

	ozs.	drs.
68 Pdr.	4	3
42 „	2	12
32 „	2	8
24 „	1	9½
18 „	1	8
12 „	1	0½
9 „	0	14
6 „	0	9½

ch.

Plate. 7.

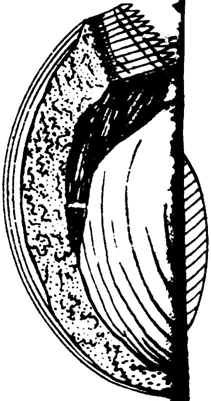
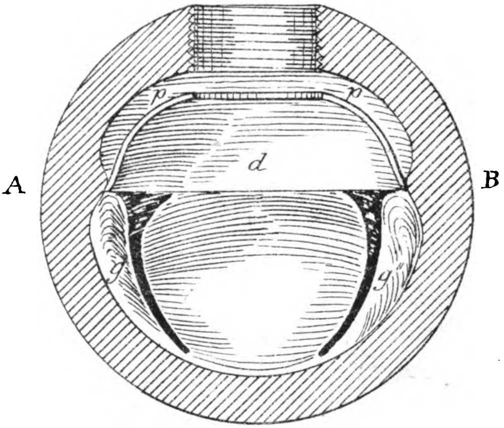


Fig. 1.



Madr

W. P. E.

MEMORANDUM

ON

SHRAPNEL SHELLS.

8th February 1858.

Certain opinions in condemnation of the *principle of construction* of the Diaphragm Shrapnel Shell having been widely circulated—which opinions have been formed upon most imperfect data—the following observations are drawn up with a view to afford such information as may place this matter in its proper light, and to remove the false impressions which now exist in respect to the subject generally,—and I am sure that a careful consideration of recorded facts, and of the explanation which I shall afford, will show, that the Shrapnel Shell as arranged by the inventor has defects of a very serious character; and that if the principles which have guided me in constructing the Diaphragm Shell are properly carried out, every defect will be rectified, and the service with this nature of projectile will be rendered capable of a development considered hitherto impracticable.

In the early part of 1849, I first became aware of the unsatisfactory results which were obtained in the practice with Shrapnel Shells, from very frequent "premature explosions," and for the purpose of overcoming the defect, I designed a Fuze similar in the principle of its construction to that now adopted in the service for horizontal shell firing.

My views upon this subject having been brought to the notice of the Master-General of the Ordnance, were referred by him to the Ordnance Select Committee, who recommended that a series of trials should be made in order to determine the true cause of failure.

These experiments took place in the Marshes at Woolwich in 1849, and the results proved beyond doubt (at least to my mind) that the failures resulted in a great measure from the bursting charge being mixed with the bullets, and that no alteration of the fuze would altogether prevent premature explosions.

The general opinion then entertained in regard to this matter was, that the shell was not sufficiently strong to withstand the "shock of the discharge," in fact that the shell was broken by the direct action of the charge in the gun.

This opinion was found to be fallacious by the following experiment, which also manifested the principal defect of General Shrapnel's arrangement.

8-inch, 32-pr. and 24-pr. Shrapnel shells carefully selected were prepared as follows, and fired with charges of 10 lbs., 10 lbs. and 8 lbs. respectively.

1. Filled with bullets and *the bursting powder*, and with a solid plug of wood firmly driven into the fuze-hole.

2. Filled with bullets, but *without the bursting powder*, and with a solid plug of wood firmly driven into the fuze-hole.

Nearly the whole of the shells with the bursting powder exploded in the gun, but there was not ONE *breakage with the shells* WITHOUT THE BURSTING POWDER.

The same descriptions of shells were then fired with a reduction of 2 lbs. in the charges, with similar results.

I noticed in these trials that some of the shells *with bursting powder* which were not destroyed in the gun, burst upon striking the butt, although there was no fuze in the shell.

These results led me to the following conclusions:

1st. That with the most perfect fuze premature explosions would occur.

2ndly. That the shell was strong enough, if properly made, to withstand the direct action of the charge; and

3rdly. That by the shock which the projectile received at the "discharge," sufficient heat was evolved in some *part* of the interior of the shell, by friction or condensation, to ignite the bursting powder.

In order to diminish the effect from friction, I suggested that the interior of the shell should be coated with a cement.—Some shells so prepared were fired, but with most unsatisfactory results; in fact, if I recollect rightly, there were more failures with the coated, than with the ordinary shells.

I then proposed the principle of separating the bursting charge from the bullets, as the *only* means of *securing* success. Some shells arranged according to this principle were fired, and the results of the trial were very satisfactory.

The Select Committee did not then agree with me as to the necessity of separating the powder from the bullets, and proposed, after a very limited trial, to remedy the defect by reducing, very considerably, the charges of the guns.

This proposal I felt sure would, if carried into effect, only lead to disappointment; for besides seriously diminishing the effect of the projectiles as regards the velocity of the bullets, premature explosions would still take place, although not perhaps to the same extent as before.

If it were necessary to raise the whole of the bursting powder, or any large portion of it, to a certain temperature to cause ignition, then by limiting the charge, failures from premature explosion might be entirely prevented. But when, as is the case, the ignition of one grain, or portion of a grain, is sufficient to explode the whole charge, it is clear that no positive security against failure can result by reducing the charge in the gun when the bullets are mixed with the powder.

The recommendations of the Select Committee, as stated above, were adopted, and the charges for the 8-inch, 32-pdr. and 24-pdr. were fixed at 6 lbs., 6 lbs. and 5 lbs. respectively

As the suggestion of separating the powder from the bullets was not entertained, I proposed that all Shrapnel shells should be constructed according to the inventor's original pattern, namely, with a "lip," by which arrangement the bullets could be packed firmly in the shell, and thus cause a diminution in the action tending to ignite the bursting powder.

A number of shells so constructed were fired at Shoebury Ness in 1852, and the results were satisfactory;—the same pattern however failed most completely in 1853, and altogether the practice both at Shoebury Ness and elsewhere most fully confirmed my views in respect to the effect of reducing the charge of the larger nature of guns.

Similar experiments to those carried on at Woolwich in 1849, and which I have already noticed, were made at Shoebury Ness; and so striking were the results that even the most sceptical were forced to acknowledge that to render the shrapnel shell an efficient projectile, a separation of the bullets from the powder was necessary.

In the trials made in 1849, the fuze holes were secured with solid wooden plugs, and it was imagined by some that these wooden plugs had been forced out when the shells were in the gun, by the reaction of the bullets, and that the flame from the explosion of the charge was communicated to the bursting powder through the fuze-hole. This hypothesis was put to the test of experiment:—14 24 pdr. Shrapnel shells were carefully selected, the fuze-holes tapped with a screw, and the shells thoroughly cleaned. 8 were filled with bullets closely packed, and with the bursting charge, viz., 6 ozs. of powder, and the remaining 6 with bullets, but *without* the bursting powder.

The fuze-holes of the whole were perfectly secured by *screwing* in gun metal plugs. These shells were fired at Shoebury Ness on the 7th to 11th of October, 1853, from a 24-pdr. Howitzer, with charges of 2½ lbs., when *six out of* *the eight shells which contained bursting powder* burst in the bore of the howitzer, but the 6 without the bursting powder were uninjured.

In the very extensive experimental and other practice with Shrapnel shells of the original construction which I have had an opportunity of witnessing since 1849, I have particularly noticed the varied character of the results. At times few, if any, premature explosions occured; at other times almost every shell that was fired burst in the gun, although the conditions appeared to be precisely the same; and I observed also that with the 24-pdr. Howitzer, with the small charge of 2½ lbs., the failures were generally far more frequent than with other field guns.

Although the suggestion of separating the bursting powder from the bullets was rejected by the Select Committee in 1849, I felt sure from the experiments which I had witnessed, that sooner or later this principle would be adopted; and I only waited for a favourable opportunity to renew my proposal.

This occurred in 1852—the date I am not certain of—when some experiments were made in the Marshes with Field Artillery, and the Miniè rifle, in which the extremely unsatisfactory condition of Shrapnel shells was plainly manifested; and I immediately brought the subject to the notice of the Master-General, and proposed the Diapbragm pattern.

In designing the Diaphragm Shrapnel shell, an endeavour was made to fulfil the following conditions:

1st. That the shell shall resist the shock from the explosion of the full service charge; and

2nd. That the bullets when relieved shall be but slightly affected in the direction of motion of the shell, by the action of the bursting powder.

In regard to the first point—as the velocity of the bullets must be considerable to render them effective—and this velocity being derived from the action of the charge in the gun—any reduction in the charge must cause a corresponding reduction in the effective range ; hence the advantage of firing Shrapnel shells with the full service charge : but whatever charge is used, there ought to be great security that no premature explosions shall occur, or this description of projectile could not be used with advantage under a great variety of circumstances, which must constantly occur in warfare—particularly now, when, from the great perfection in the rifle, skirmishers will be employed so much more extensively than heretofore.

With reference to the second condition, namely, that the bullets when relieved shall be but slighty affected in the direction of motion of the shell by the action of the bursting charge.—From the great dificulty of correctlv judging the distance of an object, or even where a shell burst in respect to an object, the real efficiency of the Shrapnel shell will be much affected by any great dispersion of the bullets from the action of the bursting powder; in fact it is a matter of great importance to limit the divergence of the bullets from the trajectory of the shell to such an extent, as to make it a matter of little consequence whether the shell bursts 50 or 100 yards from the object fired at.

A separation of the bullets from the bursting powder being absolutely necessary to fulfil the first condition, it became a question as to the best mode of carrying out the principle. My first idea was to arrange the shell according to the plan which I afterwards adopted to overcome the defect of premature explosions in the old Shrapnel shells ; but I soon perceived that the arrangement, although simple, would not fulfil the second condition ; for in the first place, the action of the bursting powder must be sufficiently great to break the shell into comparatively small pieces in order to separate the bullets; and in the second place, the whole force from the explosion of the bursting powder acting from the centre of the mass in an outward direction, would thereby cause great dispersion in the bullets.

These considerations induced me to seek for some more efficient plan, and to adopt the arrangements carried out in the Diaphragm pattern.

The peculiar features of the Diaphragm Shrapnel shell consist,—in the separation of the interior of the shell into two parts by a wrought iron partition or diaphragm—and in the metal of the shell being so disposed as to cause the bursting powder to open the shell in a manner to relieve the bullets, without causing irregular dispersion from the trajectory of the Projectile.

The accompanying drawing, figures 1 and 2, (Plate 7) represent sections of the Diaphragm Shrapnel shell. Fig. 1 is made by a plane which contains the axis of the fuze hole—and Fig. 2 by a plane at right angles to this axis.

The bursting powder, which is contained in the chamber (*p* fig. 1,) being in advance of the bullets, and entirely separated from them by the wrought iron partition (*d*,) is not affected by the shock received from the explosion of the charge in any greater degree than the bursting powder of a common shell—this arrangement, therefore, entirely remedies the defect found to exist in the original construction, in reference to the ignition of the bursting charge by the action of the bullets,—and it only remains to regulate the thickness, or rather strength, of the shell to resist the direct action of the force of the charge, in order to obtain security against premature explosions.

It appears from the results of many experiments, that the thickness of metal adopted by General Shrapnel, is all that is necessary to secure the above result, even when the shells are projected with very high charges, provided the material be of a strong and tough character, and that there be an absence of flaws. This thickness of metal has therefore been taken as the basis of construction in the Diaphragm pattern.

The next point to be considered, and it is one of great importance, is that which refers to the action of the bursting powder. It is quite evident, that unless some provision were made to regulate the effect of the bursting powder, the principle of General Shrapnel would be, to a great extent, sacrificed—in fact, the explosion of the bursting powder would separate the shell at the part (A B fig. 1) where the wrought iron partition joins the interior surface, and the bullets would either not be relieved from the shell, or would be affected more or less in their proper course, according to the relative positions of the powder and bullets at the moment of explosion, and the force of the explosion itself.— A special arrangement has, however, been made, which completely meets the difficulty; it is as follows:

1st. In order to prevent fracture where the diaphragm joins the interior surface of the shell, the resistance to fracture is made considerably greater through A B than at any other part of the shell, as shown in Fig. 1; and

2dly. Four grooves (*g*, *g′*, *g″*, *g‴* Fig. 2), and (*g*, *g″*, Fig. 1), are made in the interior, extending from the fuze hole to points near the bottom of the shell, forming so many lines of "least resistance", by which arrangement, in connection with that in relation to the general distribution of metal, the shell is opened in the way represented in Fig, 3, (taken by the camera from a shell burst with the regular bursting charge) and the bullets are affected but in a very slight degree, in their direction of motion, or dispersion by the action of the bursting charge.

The following objections have been urged against the principle upon which the Diaphragm shell is constructed:

1st. That the projectile being "excentric," from the relative positions of the bullets and powder, great irregularity in flight must result.

2ndly. That owing to the powder being on one side of the bullets, their velocity and proper direction of motion are considerably affected.

3rdly. That a complete separation of the powder and bullets cannot be secured.

In regard to the first point—although the projectile be "excentric," yet, as the *centres of force and gravity* are in a straight line which also represents the *direction* of the force produced by the ignition of the charge, no rotation will be generated in the projectile, and consequently no deflection will result from the peculiar arrangement of the mass.

The above objection was made to the diaphragm shell when it was first proposed; and in the experiments which were carried on at Shoebury Ness, particular attention was directed to this point, and it appears from the reports that the flight of the projectile was very regular.

As to the second objection—the explanation already given, is sufficient to show that the principle of construction is not defective in this particular; in fact, that if the design be efficiently carried out, the peculiar arrangement in regard to the bursting powder and bullets will act beneficially in respect to the motion of the bullets when relieved from the shell;—but even if the desired object be not attained, as to the fracture of the shell, owing to imperfection in the manufacture or other causes, and the force of the bursting charge acts in an opposite direction to the motion of the projectile—it is clear, from the very small quantity of powder in the bursting charge, and from the extremely short time during which the force can act, that the velocity of the bullets will be but slightly affected—and a simple experiment will show this to be the case.

In reference to the third objection—namely, that a complete separation of the powder and bullets cannot be secured—I have only to observe, that with a proper system no difficulty whatever is experienced in this matter, or in any other particular in relation to the manufacture of the projectile.

I am quite aware that the Diaphragm shells in store are defective, but I must observe at the same time, that when the urgent demands for these shells were made, all was done that could be done, under the circumstances, to meet the wants of the service.

When the Diaphragm pattern was first proposed, I had no opportunity of making the necessary experiments, to determine various details in regard to the arrangement of the wrought iron partition, the depth of the grooves, &c. &c.: which, although in appearance but trifling, are nevertheless points upon which the success of the principle depends. However, as the results of the first trials at Shoebury Ness in 1852 and 1853 were reported as highly satisfactory, and as there was neither time nor opportunity to prosecute the inquiries in relation to the *most efficient* arrangement—at a period when the shells were required for immediate service—the original design was adhered to.

The shells in question were supplied by contractors, the majority of whom were totally inexperienced; and owing to the peculiarity of construction, it was impossible when the shells were delivered, to test or examine them in a way to determine whether or not the design had been correctly carried out: these circumstances alone are sufficient to account for the condition of many of the shells now in store: but although I am prepared to admit that, owing to the above causes, the Diaphragm shells which have been issued for service are defective—both in design and workmanship—I believe it will be found on trial that the effect of these shells is nevertheless very destructive.

It only remains for me to state, that during the past few months I have pursued the enquiry in regard both to the design and manufacture, with most satisfactory results; and I have every reason to believe the object for which I have so earnestly striven, will be attained—namely, to supply the service with a Shrapnel shell possessing all the valuable properties of the original invention, without its serious defects.

(Signed) E. M. Boxer, Captain R. A.,

Superintendent.

Royal Laboratories.

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